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THE UNIVERSITY OF ALBERTA

A PALAEOPATHOLOGICAL ANALYSIS OF AN HISTORIC INUIT POPULATION FROM SOUTHERN BAFFIN ISLAND, N.W.T.

BY

© ANNE KEENLEYSIDE

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF ARTS

DEPARTMENT OF ANTHROPOLOGY

EDMONTON, ALBERTA

FALL 1988

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled A Palaeopathological Analysis of an Historic Inuit Population from Southern Baffin Island, N.W.T. submitted by Anne Keenleyside in partial fulfilment of the requirements for the degree of Master of Arts.

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(Supervisor)

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Date: May 25, 1988

This thesis is dedicated to the Inuit of Pangnirtung.

ABSTRACT

Few palaeopathological studies have been conducted on historic Inuit remains in the Eastern Arctic. Recently, the skeletal remains of forty Inuit from Kekerten, an historic whaling station in Cumberland Sound, Baffin Island dating from approximately A.D. 1857 to A.D. 1925, were analyzed for evidence of disease, the goal being to assess the health status of the Kekerten Inuit during the whaling period. At the same time, the effects of Euroamerican contact on Inuit health were investigated through a comparison of the pathologies recorded in the Kekerten burial population with those previously observed in two late prehistoric/early historic burial populations in Cumberland Sound.

Analysis of their skeletal remains revealed that the Kekerten Inuit suffered from a variety of pathological conditions, including tuberculosis, fractures, iron deficiency anemia, osteoarthritis, spondylolysis, osteoporosis, osteophytosis, ankylosing spondylitis, dental caries and periodontal disease.

A decline in Inuit health during the whaling period is indicated in the skeletal remains by the appearance of iron deficiency anemia and an increase in antemortem tooth loss. The devastating impact of the presence of European and American whalemen on the Kekerten Inuit is more

clearly demonstrated in the demographic reconstruction of the settlement, specifically the significant decrease in life expectancy at birth, and the dramatic increase in the mortality rate among children, particularly those aged 2 to 5 years. The latter observation is attributed to the occurrence of epidemics at the whaling station during the nineteenth and early twentieth centuries.

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CHAPTER I

INTRODUCTION

The field of palaeopathology, "...the study of diseases in ancient human populations" (Steinbock 1976: ix), traces its roots back to the 1800's when Warren (1822) first reported on artifical cranial deformation in native North Americans. Since that time, many burial populations throughout the world have been analyzed for the presence of disease. However, until relatively recently, paleopathological analyses of skeletal remains in the Eastern Arctic have been conspicuously absent.

Early studies of Eastern Inuit skeletal populations focused on the measurement and description of the remains with the purpose of identifying "Eskimo" morphological features. Oetteking (1931) presented somatometrical data from 10 adult males and 13 adult females from the Cape Dorset and the Fox Channel regions of Baffin Island collected by the Putnam Baffin Island expedition of 1927. As well, he reported on an incomplete skeleton from Sculpin Island, Labrador. Fischer-Moller (1937) described the cranial and infracranial remains of prehistoric Inuit from the Naujan site in Repulse Bay. In addition, he presented data on 10 skulls from northern Baffin Island and 2 skulls from the Hudson Bay region.

Oschinsky (1964: 30) compared Inuit crania from Greenland, the eastern, central and western arctic, and Siberia with Indian crania and found that "...the total morphological pattern of the Eskimo cranium and mandible is most distinctive". Other articles published by Oschinsky include a paper on mandibles from two Cape Dorset sites (1960), a brief report on maxillary lateral incisor tooth crowding (1961) and an article on facial flatness and cheekbone morphology (1962).

In 1910, Hrdlicka (1910) made a brief reference to pathologies in a report on the Inuit of Smith Sound. In 1922, Grant (1922) published a report describing the pathologies found in the remains of an Inuit skeleton from the west coast of Hudson Bay. Three years later, Leigh (1925) presented a detailed analysis of Inuit dental pathology. In 1960, Laughlin and Taylor(1960) described the skeletal pathologies of an adult male from the west coast of Ungava Bay.

With the exception of the few references noted above, the first detailed publication on Eastern Inuit skeletal pathologies did not appear until 1962 when Merbs and Wilson (1962) reported on the pathologies of the vertebral column of the Sadlermiut, a group of Inuit from Southampton Island, Hudson Bay, who became extinct in 1902-1903. The remains, both prehistoric and historic,

were excavated from the site of Tunirmiut located at Native Point, Southampton Island, in 1955 by Henry B. Collins of the National Museum of Natural History, Smithsonian Institution, and in 1959 by a University of Wisconsin team under the direction of William S. Laughlin. Merbs later incorporated his data on Sadlermiut vertebral pathologies into a Master's thesis (1963).

In 1969, Merbs (1969) completed his PhD dissertation, which focused on the relationship between degenerative and traumatic skeletal pathologies and human activity patterns among the Sadlermiut. A revised version of this thesis was published in 1983 (Merbs 1983). Merbs has also published an article on anterior tooth loss (1968).

More recently, Hartweg and Plumet (1974) analyzed the skeletal remains of prehistoric and historic Inuit from the Ungava Bay region of northern Quebec and briefly noted their pathological findings. Buikstra (1976) reported the presence of two types of skeletal pathology, tuberculosis and Harris Lines, in the remains of 28 Caribou Inuit, currently housed in the National Museum of Canada, the Eskimo Museum of Churchill, the University of Toronto Museum, Dartmouth College Museum and in private collections. Cassidy (1977) described a probable malignant tumor in a Sadlermiut mandible, while Way (1978)

analysed the skeletal pathologies of a late prehistoric/early historic Inuit population from Labrador.

The most recent investigation of Eastern Inuit skeletal pathologies was conducted by Salter (1984), who, from 1975 to 1978, analyzed the remains of 48 individuals from Niutang, and 49 individuals from Tasioya, two burial sites in Cumberland Sound, Baffin Island dated to A.D. 1750-A.D. 1850. The primary goal of the project was to obtain information on the skeletal biology and burial practices of the Thule people. Her dissertation included a description of the skeletal pathologies of 40 individuals from these sites.

Most of the palaeopathological studies of Inuit remains to date have focused on prehistoric or early historic remains. Investigations of later historic Inuit skeletons have been completely lacking. This thesis represents a first step towards filling this gap by presenting new data from a recent investigation of historic Inuit burials at Kekerten (see Plate 1), the site of an historic whaling station located in Cumberland Sound, Baffin Island, approximately 50 kilometres south of the community of Pangnirtung (see Figures 1 and 2).

In the early 1980's, Kekerten was selected by the Pangnirtung Tourism Committee and by the Department of Economic Development and Tourism, Government of the

Figure 1 Map of the Eastern Arctic Showing Research Area (modified from map of N.W.T., published by Travel Arctic, Yellowknife, N.W.T.: n.d.)

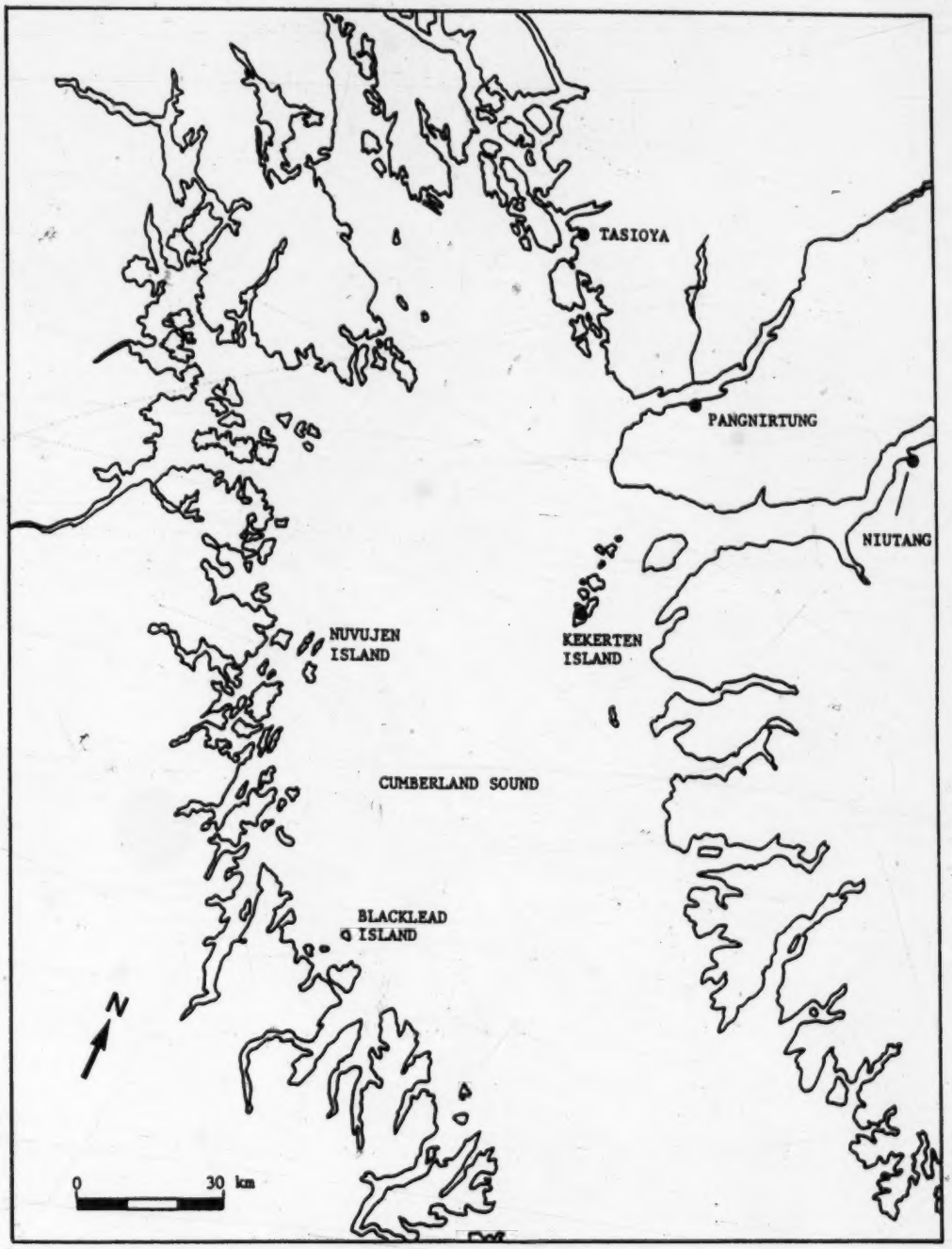


Figure 2 Research Area in Detail
(modified from Map 28, Report, Inuit Land Use and Occupancy Project, Freeman 1976: 141)

Northwest Territories, as a potential site for an historic park. In 1983, Marc Stevenson, then an historic archaeologist with the Prince of Wales Northern Heritage Centre in Yellowknife, began archaeological investigations at Kekerten with the purpose of assessing the historical and cultural significance of the site. Information on the size and age of the site was obtained and an inventory of surface features and artifacts was taken. During this field season, nearly 300 major surface remains including 64 Inuit graves were recorded. In addition, a test excavation of an Inuit dwelling was undertaken (see Stevenson 1984, 1985, 1986a and 1986b). Archaeological investigations of the site were augmented by interviews with two former inhabitants of the whaling station.

During his first field season at Kekerten, Stevenson found many of the Inuit graves to be very badly disturbed. In a number of cases, the remains had been scattered over the ground in the vicinity of the graves. It became apparent that prior to any on-site visitation by tourists, the graves would have to be cleaned up and recontructed. Therefore in 1986, with the permission of the Pangnirtung Hamlet Council, an investigation of the Inuit burials at Kekerten was initiated, the primary goal of the project being to reassemble the graves.

Since very little palaeopathological research had previously been done on historic Inuit remains in the Eastern Arctic, the project provided an excellent opportunity to examine the remains for evidence of disease. Therefore, research at the site focused on an assessment of the health status of the Kekerten Inuit during the whaling period (A.D. 1840-1915) through an analysis of skeletal pathologies. At the same time, the existence of good comparative samples, the Niutang and Tasioya burial populations previously analyzed by Salter (1984), provided an opportunity to investigate the effects of Euroamerican contact on Inuit health. The analysis of skeletal pathologies at Kekerten was augmented by historical research so that a broader picture of the health of these individuals could be obtained.

CHAPTER II

HISTORY OF THE SITE

The history of Kekerten essentially begins with the development of the Cumberland Sound whaling industry following the rediscovery of the Sound in 1840, nearly 300 years after John Davis first entered its waters. However, in order to understand how the Sound, and later Kekerten, became the focus of the whaling industry, it is necessary to trace the development of this industry from to its early beginnings in the Eastern Arctic.

Baffin's voyage in 1616 had indicated the potential value of a whale fishery in Davis Strait (Harper 1972: 12), and during the 1600's, European ships began making sporadic visits to the Strait. In general, however, the Arctic whaling industry in the seventeenth century remained confined to Spitzbergen and the area off the east coast of Greenland. With the depletion of the whale population in this region around the turn of the century, the industry turned its attention westward to Davis Strait and in 1719, a regular and intensive whale fishery, initiated by the Dutch, began operation in the Strait.

Throughout the eighteenth century and the first two decades of the nineteenth century, whaling was confined to the eastern waters of the Strait due to an impenetrable barrier of ice in Baffin Bay which prevented the ships

from reaching the Baffin Island coast (Francis 1984: 23). Contact between the whalers and Inuit occurred occasionally along the west coast of Greenland; however, these contacts were transitory and trading was the only outcome (Francis 1984: 8).

The first recorded crossing of Baffin Bay by a whaler occurred in 1817 when two vessels under the command of Captain Muirhead made the crossing, reaching the Canadian shore and then returning along the Greenland shore (Cooke and Holland 1978: 138). In the following year, John Ross, in his search for a northwest passage, sailed northward along the Greenland coast of Davis Strait to the northern waters of Baffin Bay, proceeded across the bay and sailed southward along the coast of Baffin Island.

Once the feasibility of crossing Baffin Bay had been established, whalers began to follow this new route regularly, lured by accounts of more profitable whaling grounds in the vicinity of Lancaster Sound and Pond Inlet at the northern end of Baffin Island. This region soon became the favourite whaling ground, despite the fact that this new route across Baffin Bay was considerably more dangerous than the earlier whaling routes which had remained confined to the eastern side of Davis Strait. Passage across Melville Bay, commonly known among whalemen as the "breaking-up yard". was particularly perilous and

many ships were caught in the ice here and destroyed (Francis 1984: 24).

The British began to dominate the Davis Strait whaling industry in the early 1800's, taking over from the Dutch who had led the whaling activity in the Strait throughout most of the eighteenth century. The first quarter of the nineteenth century was a period of expansion and prosperity for British Arctic whaling. Between 1814 and 1817, an average of nearly 150 ships, the largest fleet in the industry's history, visited Davis Strait annually (Holland 1970: 25).

The first direct contacts between whalemen and the Inuit of the eastern Canadian Arctic occurred between 1820 and 1840. These early contacts were brief and sporadic, however, due to the frequent inability of the whalers to make landfalls on the Baffin Island coast. As Ross (1979: 251) notes:

> Along much of the Baffin Island coast the movement of whalers was unpredictable and irregular...depending on the southward migration of whales and the state of sea ice and weather...Accordingly, contact with the vessels was largely fortuitous and of short duration, and systematized trade and employment could not develop.

Prolonged interaction between the whalemen and the Inuit occurred only when whaling ships were trapped in the ice and forced to winter over (Stevenson 1984: 10).

The great success that the British whaling industry enjoyed during the first three decades of the century temporarily came to an end with a series of disastrous seasons in the years 1830, 1835 and 1836, which resulted in the loss of over twenty ships. By 1837 it had become apparent to those in the whaling industry that if the industry was going to survive, new approaches would have to be taken.

One possible solution was the establishment of a permanent settlement of whalemen in the Arctic. Supporters of this idea initially suggested that a station be established close to the popular whaling grounds of Pond Inlet and Lancaster Sound. However, Captain James Clark Ross, the most enthusiastic supporter of the idea of a permanent station, disagreed with this location, noting that this area was not always accessible in bad seasons (Holland 1970: 27). He preferred a more southerly location, somewhere between Cumberland Sound and Cape Walsingham.

While Ross' suggestion was a good one, the coast of southern Baffin Island was not well known. Therefore, before a station could be established, the coast south of Cape Walsingham would have to be explored. The outfitting of an expedition was expensive, however, and whaling companies were reluctant to engage in such a task,

preferring to delegate the responsibility of exploring the new region to the Government. The Government, on the other hand, was slow to respond to this issue and plans for the establishment of a whaling station were temporarily halted.

Prior to 1837, one attempt had been made to explore the southern coastal regions of Baffin Island. In 1833, George Simpson and William Penny led a routine whaling expedition to northern Baffin Bay. Returning along the coast of Baffin Island, Simpson made a number of inquiries among the Inuit at Exeter Bay regarding the possible existence of new whaling grounds to the south. These were the first of a number of inquiries made among the Inuit of southern Baffin Island by Europeans seeking new whaling grounds (Cooke and Holland 1978: 159). The Inuit reported the existence of a bay a short distance away and Penny was dispatched to investigate it. He located Exeter Sound and sailed approximately 50 km. into it; however, seeing nothing of interest, he turned back.

Towards the end of the whaling season in 1839, Penny had another opportunity to explore briefly the southern coast of Baffin Island. He sailed to Durban Island, where he made inquiries among the Inuit about the large bay rich in whales that was reported to exist to the south.

Accompanied by four Inuit, Penny again sailed into Exeter Sound, only to discover that it ended abruptly.

When he returned to Durban Island, he met an Inuk named Eenoolooapik, who drew for him a map of a large bay to the south of Exeter Sound. Penny was convinced that this was Cumberland Sound, the large whaling ground that he had been looking for. Since there was no time to do any further exploration, however, Penny returned to Britain, taking his Eskimo companion with him in the hope that Eenoolooapik's presence might help Penny win support from the Government for further exploration in the region (Holland 1970: 30).

Penny received no financial support for an expedition in search of Cumberland Sound. He was, however, granted permission to search for the Sound at the end of the fishing season if time permitted; and in July 1840, Penny discovered Cumberland Sound, becoming the first European known to enter the Sound since it was first discovered by John Davis in 1585 (Cooke and Holland 1978: 169). Penny returned home with reports of the potential value of a whale fishery in Cumberland Sound, and in the years that followed, this region became one of the most important whaling grounds in the eastern Canadian Arctic, thereby restoring the floundering whaling industry for a time.

With the rediscovery of Cumberland Sound, which Penny named 'Hogarth's Sound', the interaction between the whalemen and the Baffin Island Inuit began to intensify, particularly when whalers began to winter over deliberately in the Sound in order to take advantage of spring whaling at the floe edge. The first incident of intentional overwintering in Cumberland Sound occurred in 1851-1852 by a group of Americans from the ship McLellan. It was at this time that the systematic employment of Inuit by the whalers began, the Inuit becoming suppliers of food, clothing and labour (Francis 1984: 39). The American whalemen established very friendly relations with the Inuit and there was no scurvy or other sickness (Lubbock 1937: 357).

When Penny learned that the Americans had wintered over in the Sound, he became very concerned about the welfare of the Inuit and the detrimental effects that the whalemen were having upon them. He was also fearful that the Americans would establish their own territory in the Sound. Gathering together a group of Aberdonian businessmen, Penny formed the Aberdeen Arctic Company with plans to obtain from the government a grant of land in the Sound on which to found a permanent settlement.

In 1853, Penny wintered over in Cumberland Sound at Niantilik Harbour near Blacklead Island. During December

of that year, "...cholera broke out, and carried off a third of the Esquimaux who formed the little colony at Newacktoolick Harbour" (Penny 1854, cited in Holland 1970: 38). Finally, in 1857, the first permanent whaling stations in Cumberland Sound were built by the Scots at Kekerten and Nuvujen.

Following the construction of a permanent whaling station at Kekerten, many of the Cumberland Sound Inuit migrated to the station where they were employed in the whale fishery for much of the year, supplying the whaling crews with food and clothing during the winter, guiding the whalers on hunting excursions using their skill as boatmen, and helping to transport the whale blubber to the ships (Ross 1985: 156). In return, they received as payment for their services such items as guns and ammunition, metal cooking and sewing implements, summer clothing, and weekly rations of flour, molasses, biscuits, sugar and tobacco. Since European goods were very desirable to the Inuit, most of the natives were more than willing to work for the whalers in order to acquire these items. Despite the modest wage that they received, the Inuit preferred restricted but assured gains to those that were larger but uncertain (Hantzch 1977: 40).

When Penny first discovered Cumberland Sound in 1840, he estimated the Inuit population to be 1000. Seventeen

years later, the native population was estimated at 350 (Holland 1970: 40). Penny's continuing concern for the welfare of the Inuit and his awareness of the increasingly deleterious effects of the whalemen on the Inuit prompted him to write to the Moravian Church requesting that a missionary be sent to Kekerten. That the health of the Cumberland Sound Inuit was suffering as result of their contact with the whalemen is suggested in Penny's written request for a missionary. He noted that:

> The natives are a most intelligent race, and showed very anxious to receive the teacher I told them of. Many have died since the date of my last visit (Penny 1856, cited in Holland 1970: 39).

The Church answered his request and in 1857, after three unsuccessful attempts to bring a missionary to Cumberland Sound, Penny finally succeeded in bringing a Moravian missionary, Brother Mathias Warmow, with him to Kekerten.

Warmow was distressed by the poor condition of the Inuit, noting:

> I am always sorry to see the Esquimaux wearing European clothes, and, in short, imitating the Europeans in all respects. They were undoubtedly better off in their original state, and more likely to be gained for the kingdom of God. But when they begin to copy our mode of life, they are neither properly Europeans nor Esquimaux, and will speedily die out, in consequence of the change (Warmow 1859, cited in Holland 1970: 40).

Although it had been Penny's hope that a permanent mission could be established at Kekerten, his plan was rejected by

the Mission board due to the small size of the Inuit population (Holland 1970: 40). As a result, the settlement remained without a missionary for the next 38 years.

In 1857, Kekerten, with an Inuit population of 150 (Harper 1981: 46), was the largest settlement in Cumberland Sound. In the early 1860's, an American station was constructed at the settlement (Stevenson 1984: 63-64), and at the same time, a number of other permanent whaling stations, including Cape Haven and Blacklead, were built in the Sound. It was during this decade that the Cumberland Sound whale fishery reached its peak in terms of the number of whales secured and profits made.

By 1870, the whale population was declining rapidly, necessitating a diversification in the economy by the whaling stations in order to maintain profitable operations. While whaling continued, sealing and trading also became important activities. At the same time, the number of ships visiting the Sound decreased dramatically, the Americans began scaling down their operations, and the Scottish whalers ceased wintering over in the Sound (Stevenson 1984: 43).

In 1883, the American anthropologist Franz Boas arrived at Kekerten and spent the following year conducting fieldwork among the Inuit as well as a number

of geographical explorations of the region. The population of the settlement at this time was 82 (Boas 1964: 18), representing a decrease of almost 50% from 1857. Two theories have been proposed to explain this decrease. The decline in the whale population and the consequent decrease in employment opportunities at the whaling station, as well as the diversification of the economy, may have prompted many of the Inuit to return to the land (Stevenson 1984: 65-66). Alternatively, disease may have caused the reduction in the population at the whaling station (Stevenson 1984: 66). During his stay at Kekerten, Boas recorded eight deaths. An outbreak of diptheria in the fall of 1883 claimed the lives of five children (Boas 1964: 18). This disease, previously unknown to the Inuit, spread throughout Cumberland Sound, resulting in the deaths of many children (Boas 1884: 261). Boas postulated that the only two ships to visit Cumberland Sound that season, the Catherine and the Germania, must have been responsible for bringing the disease although neither crew showed any signs of illness (Cole 1983: 36). In fact, Boas himself was blamed by the Inuit for spreading the disease (Boas 1884: 261). During this same time period, pneumonia claimed the lives of two women, while cancer of the rectum claimed the life of one man (Boas 1964: 18).

The Scottish whaling station continued to operate at Kekerten after Boas' departure; however, operation of the American station dwindled and in 1894 the station was bought out by the Scots (Wakeham 1898: 75). In the same year, the Anglican missionary E. J. Peck arrived at Blacklead and established a permanent mission there. In 1895, Peck made his first journey to Kekerten to spread the word of Christ to the Inuit. This was the first of several trips by the missionary to the whaling station and his teachings were not met without some resistance, particularly by Angmalik, the Inuit leader of the settlement (Stevenson 1984: 86). Peck made his last trip to Kekerten in 1902 with the Reverend E. W. T. Greenshield, who lived in the settlement from 1904 to 1905.

In 1897, William Wakeham made a government expedition to Cumberland Sound in the ship Diana, stopping at Kekerten, which Wakeham estimated to have a population of approximately 150 (Wakeham 1898: 75). This increase in the population of Kekerten from 82 in 1883 (Boas 1964: 18) to 150 in 1897 may have been due to an increase in employment opportunities at the station brought about by a slight increase in whaling during the late 1880's and the 1890's (Stevenson 1984: 82), and resource stress caused by the depletion of seals in the Sound (Stevenson 1984: 50).

Although Wakeham reported the Inuit to be well off at this time (Wakeham 1898: 24), the growing dependency of the Inuit on European manufactured goods was clearly visible. Wakeham noted that:

> In the neighbourhood of the whaling stations the natives are fast ceasing to be expert in the use of their old fashioned weapons, such as spears, small harpoons, bows and arrows, etc., as they are now pretty generally supplied with modern repeating arms, and there can be little doubt that those who have been brought up about the stations would be badly off were these closed and abandoned (Wakeham 1898: 75).

In the fall of 1903, A. P. Low, on a government expedition aboard the ship Neptune, made a brief stop at Kekerten. While the health of the natives was fairly good at this time, following the arrival of the Reverend Greenshield at the settlement in 1904, an epidemic occurred. As Fleming notes:

> The missionary had not been back at Kikkerton long before serious illness broke out in the camp. The first trouble was among the children. They contracted a disease which in many respects resembled cholera, and although he did everything in his power for them, there were several deaths (Fleming 1932: 102).

In 1907, J. E. Bernier, on a government expedition to the Arctic, stopped at Kekerten, where he estimated the population to be 150 (Bernier 1909: 46). Three years later, Bernhard Hantzsch, a German explorer, arrived at Kekerten from Blacklead Island. By this time period, few ships, if any, wintered over at the whaling station

(Stevenson 1984: 90). Therefore the Scots relied solely on their company vessel to bring them their yearly food supplies and trade goods. The wreck of the supply ship Jantina Agatha while on its way to Kekerten and Blacklead in 1909, however, resulted in the loss of many needed supplies. The winter of 1909-1910 proved to be a very difficult one for the inhabitants of both stations. Since the Europeans did not have goods with which to pay the Inuit for their services, they could not offer the natives employment. Consequently, the Inuit were left to their own resources and many suffered famine (Hantzsch 1977: 61).

Food and supplies appear to have been fairly scarce at Kekerten after the turn of the century (Stevenson 1984: 92). As well, disease continued to plague the settlement. In 1910, the 12 year old son of William Duval, a trader, died after suffering from inflammation of the bowels (Fleming 1932: 143). During the period from 1911 to 1913, there was much sickness among the Inuit and Europeans at Kekerten and Blacklead. As Fleming noted:

> Besides the usual coughs and colds which are experienced each year at the change of the seasons, especially in the autumn, there were outbreaks of diptheria and...very serious and more widely spread epidemics of skin disease (Fleming 1932: 173).

A shortage of food and supplies and the lack of employment opportunities among other factors, initiated

the gradual abandonment of Kekerten. The year 1915 marked the end of the whaling industry in Cumberland Sound and the eastern Arctic, and a shift to fur trading. By this time, few families remained at Kekerten. Periods of famine plagued the settlement during the second decade of this century. In 1924, for example, sealing was poor around Kekerten and the Inuit consequently had very little to eat (Wight 1925: 56).

The station was finally abandoned in 1925 and for the next thirty years, was used only periodically as a seasonal hunting camp and as an outpost camp by several families (Jaco Koonielusie, personal communication, 1983, cited in Stevenson 1984: 102). In 1987, construction began on a boardwalk at Kekerten and in the summer of 1988, the site is scheduled to open as an historic park.

CHAPTER III

METHODOLOGY

In order to examine the health of the Inuit at Kekerten during the whaling period as reflected in the skeletal pathologies, it was first necessary to determine the size and extent of the burial population at the site. This was done by systematically walking over the entire site and the surrounding hills looking for graves. As each grave was located, it was photographed and numbered with orange flagging tape to allow for easy identification and relocation.

Basic to any evaluation of disease processes in archaeological specimens is knowledge of the sex and age at death of an individual (Ortner and Putschar 1985: 29). Therefore, once the identified graves were numbered and photographed, the age and sex of each individual associated with the graves were determined where possible. In a number of cases, the absence of sufficient skeletal remains or the inaccessibility of the remains to the researcher (eg. cases where the coffin was nailed shut and therefore not opened), prevented the assessment of age and sex.

The determination of the sex of each adult buried at the site was based on visual observation of the skull and pelvic bones, and on measurement of the skull and several

of the long bones and flat bones. Since the most reliable indicator of sex in the skeleton is the pelvis, sex differences being directly related to male/female differences in the reproductive functions, this skeletal region was preferred in the assessment of the sex of an individual whenever present. Indicators of sex recorded for the innominates included size of the sciatic notch and acetabulum (Bass 1971), the ischium-pubis index (Washburn 1948), the pubic index (Miles 1986), the appearance of the medial aspect of the ischio-pubic ramus, and the presence or absence of a ventral arc and subpubic concavity (Phenice 1969).

In cases where the innominates were either absent or too damaged to observe accurately, the skull, considered to be the second best indicator of sex in the skeleton (Bass 1971: 72), was utilized. Sex differences in the skull reflect the fact that males are generally larger, more robust and more muscular than females (although a number of Kekerten female skulls were found to be quite muscular, undoubtedly a reflection of their vigourous lifestyle). Features of the skull used to determine sex included size of the supraorbital ridges, sharpness of the supraorbital margins, size of the palate, prominence of the muscle markings, size of the mastoid processes, and chin shape (Bass 1971). Measurements of the skull and

mandible were also taken for sex determination by discriminant function analysis (see Giles and Elliot (1963), Giles (1964), and Hanihara (1959)).

Measurements of several of the long bones and the scapulae were taken in cases where neither the pelvic bones nor the skull were present, and as a crosscheck in cases where the skull was present but the pelvic bones were absent. Measurements were taken to the nearest millimetre using an osteometric board, spreading calipers, sliding calipers and a measuring tape (see Appendix A for description of measurements). For comparative purposes, the left bones were used whenever possible. Once the necessary values were obtained, they were compared with the established standards in order to determine the sex of the individual in question. Specific measurements taken for sex determination included the midshaft circumference of the femur (Black 1978), maximum head diameter of the femur (Stewart 1979), nutrient foramen circumference of the tibia (Iscan and Miller-Shaivitz 1984), maximum head diameter of the humerus (Stewart 1979), length of the manubrium and mesosternum (Jit et al. 1980), glenoid length of the scapula (Stewart 1979), and maximum length, breadth and height of the talus (Steele 1976) (see Appendix B).

Most of the above sexing techniques are based on North American white and black populations. Unfortunately, no methods of sex determination have been developed using an Inuit population. Therefore caution was exercised when applying the published standards to the Kekerten population, particularly in cases where the skull and pelvic bones were absent. For this reason, multiple criteria were used whenever possible in order that a more accurate assessment of sex could be obtained.

If a particular sex was clearly indicated by the pelvic bones or by the skull plus the long bones, the individual was recorded as being male (M) or female (F). In situations where either the skull alone or a number of the long bones indicated one particular sex but could not be conclusively assigned to that sex due to the absence of the pelvic bones, the individual was recorded as being probable male (M?) or probable female (F?). If the sex could not be determined for a particular individual, it was recorded as unknown (?). Sex was not determined for subadults since the immature development of their bones makes accurate sexing extremely difficult (Bass 1971: 21).

The age at death of the subadults was determined by diaphyseal length (Merchant and Ubelaker 1977, Johnston 1962, Stewart 1979), degree of epiphyseal union (McKern

and Stewart 1957, Johnston 1961 and Ubelaker 1978), and tooth eruption (Ubelaker 1978). Although all three criteria were used whenever possible, diaphyseal length was used most frequently to determine age at death since there were very few maxillae and mandibles present and most of the subadults were far below the age at which the epiphyses begin to fuse and thus become useful age indicators. As well, the diaphyses tended to be better preserved than many of the other skeletal elements. Unfortunately the estimation of age from measurement of the diaphyses is not a very exact method since a wide variation in growth rates is known to exist among populations (Ubelaker 1978: 46). In addition, the standards used to estimate the age at death of the subadults at Kekerten were developed using North American Indian and white populations, not Inuit populations. Nevertheless, measurement of the diaphyses still remains a useful method of age determination for subadults.

The criteria used for estimating age in the adults were, in order of preference, metamorphosis of the pubic symphysis, epiphyseal union (in the case of the young adults), dental attrition, degenerative changes, and cranial suture closure. The pubic symphysis has been demonstrated to be a reliable indicator of age at death in the human skeleton. Therefore it was used whenever

possible as a method for age determination. Since the McKern and Stewart (1957) method of pubic symphysis aging was developed on a sample of young adult North American males, this technique was used to age Kekerten males in the younger age groups. For older males, Todd's (1920) method, based on a sample of males from younger as well as older age categories, was utilized. Females were aged using the female standards of pubic symphysis aging established by Gilbert and McKern (1973).

The use of dental attrition has been criticized by many as being an unreliable indicator of age at death due to the fact that attrition rates are influenced by dietary and cultural factors and therefore vary greatly between populations as well as between individuals of the same population (Ubelaker 1978: 64). Nevertheless, it can be a very useful method of determining age when used in combination with other aging techniques. Tomenchuk and Mayhall (1979) developed an aging technique based on measurement of the crown width, length and height of the molars in a modern Inuit population from Igloolik; however, this method was not selected for use at Kekerten since it was felt that a difference in diet between the two populations rendered the technique less reliable on the Kekerten material. Brothwell's (1981: 72) method of age determination based on molar wear in pre-medieval and

medieval British populations is considered to be the best aging technique of this type (Krogman and Iscan 1986: 361). The method is quick and easy to use, particularly in the field. As well, it was the method most familiar to the researcher. Therefore it was used to estimate the age at death of the adults at Kekerten.

Stewart (1958) demonstrated the usefulness of osteophytosis as a general indicator of age at death. He noted that in white populations, the absence of his stage 2 lipping (on a scale of 0 (no lipping), to 4 (maximum lipping)) usually indicates an age less than thirty years, while the presence of stage 2 lipping or higher indicates an age over forty years. Since the technique is not considered to be very reliable, it was used on the Kekerten skeletal remains only where insufficient remains or a lack of accessible remains prevented the use of other more accurate aging techniques.

Cranial suture closure is also considered to be a very unreliable age indicator (Ubelaker 1978: 60); however, closure of the sagittal, coronal, lamboidal, and basilar sutures was noted in several cases as a crosscheck of other aging methods.

The above methods of age determination have been developed using primarily North American white and native Indian populations. With the exception of the method

developed by Tomenchuk and Mayhall (1979), discussed above, to the researcher's knowledge no published aging standards exist for any Inuit populations. Therefore, as in the case of the techniques used for sex determination, caution was exercised when applying the above aging standards to the Kekerten burial population; and multiple criteria were used whenever possible.

Once the sex and age at death had been determined for each individual at the site, the next step was to analyze the skeletal remains for pathologies. Unfortunately, time constraints prevented the examination of all individuals for bone pathologies. Therefore a sample of the total burial population at Kekerten was selected for analysis. Since the goal of the research was to collect the maximum amount of data that time allowed, those remains that were felt to yield an inadequate amount of information were excluded from the sample. These included infant remains, which were often lost or damaged due to the fragile nature of the bones, and burials consisting of fewer than ten elements. Due to time restrictions, undisturbed graves and the less accessible graves (ie. rock graves) were also excluded from the sample.

After the exclusion of all graves that fell into the above categories, a total of forty graves remained. Since the length of the 1986 field season was limited, and it

was uncertain at that point whether a second field season would be possible, it was decided that only twenty graves could be analyzed in the time allotted. To obtain a random sample, the numbers of each of the forty graves were written on separate pieces of paper. The pieces were then folded and placed in a bowl, and twenty numbers were selected. Analysis proceeded in the order in which the numbers were drawn. Fortunately, a second field season made possible the analysis of the remaining twenty graves in the total sample.

The first step in the analysis of each of the forty graves was to record information on the type of grave (ie. box, cask, rock), the grave dimensions, the position of the body (ie. extended, flexed etc.), the orientation of the body, associated artifacts, the state of preservation and completeness of the skeletal remains, and the degree of disturbance of the remains (see Appendix C).

The next step in the analysis was to note which skeletal elements were present or absent for each of the forty individuals contained within the graves (see Appendix C). This information was necessary for obtaining an accurate diagnosis of disease since many diseases affect only certain elements or groups of elements.

Following this procedure, metric and non-metric data were recorded. A series of measurements were taken on the

cranial and infracranial remains of each individual using spreading calipers, sliding calipers, an osteometric board, a goniometer and a measuring tape (see Appendix A for definitions of measurements). Measurements were taken to the nearest millimetre and followed the descriptions of Bass (1971), Giles and Elliot (1963), Black (1978), Iscan and Miller-Shaivitz (1984), Miles (1986), Washburn (1948), Jit et al. (1980) and Saunders (McMaster Data Base) (see Appendix B). Next, forty-one cranial non-metric traits were scored (see Appendix D) .

The final step in the analysis of the sample involved the examination of each skeletal element for pathologies. At the request of the Pangnirtung Hamlet Council, no bones or bone samples were to be removed from the site. Therefore all pathological analyses had to be done in the field. Consequently, no x-rays could be obtained and no histological or chemical analyses could be performed. The bones were examined visually and all abnormalities were described in detail and photographed.

Upon completion of all analyses, the bones were put back in their graves in their original articulated position and the graves were sealed up and secured using rope and rocks. Finally, the location of each grave was mapped using a compass and 50 metre measuring tape.

CHAPTER IV

ARCHAEOLOGICAL AND PHYSICAL ANTHROPOLOGICAL OBSERVATIONS

A total of 89 graves were recorded at Kekerten over two field seasons; however, it was decided during the second field season that one of these presumed graves, which contained no human skeletal remains, was a fox trap, while three others, also not associated with any skeletal remains, were simply pieces of board that had come from neighbouring graves. Therefore these four were eliminated, resulting in a total of 85 graves at Kekerten, 50 (58.8%) of which were box graves, 22 (25.9%) cask graves, and 13 (15.3%) rock graves (see Table 1). Considering that some particularly well camouflaged graves were not discovered until the end of both field seasons, it is very likely that other graves were missed completely. Therefore the total number of graves at Kekerten may actually be much higher.

Most of the graves were situated in the rocky hills running along the western and southern edges of the site. There were two clusters of graves, one located at the northwestern end of the site (designated Burial Area 1), and the other situated in the southern area (designated Burial Area 2) (see Figure 3). These clusters were

Table 1

Kekerten Burial Inventory

Grave #	Type	Age	Range	Sex
1	cask	29.6 yrs	25-36 yrs	F
2	rock	0 yrs**	fetal 7-8 mos	---
		30 yrs	25-35 yrs	F?
		?	?	?
3	cask	A	?	?
4	box	19 yrs	18.5-20 yrs	M
5	cask	?	?	?
6	cask	A	?	?
7	cask	A	?	?
8	box	1.75 yrs	NB-3.5 yrs	---
9	cask	A	?	M
10	box	A	?	?
11	box	50+ yrs	?	M
12	cask	45+ yrs	?	F
13	rock	A	?	M
14	box	0 yrs	fetal-6 mos	---
15	box	A	?	?
16	box	7.75 yrs	7-8.5 yrs	---
17	cask	7 yrs	5.5-8.5 yrs	---
18	cask	7.5 yrs	7-8 yrs	---
19*	box	1.75 yrs	NB-3.5 yrs	---
20*	box	1.75 yrs	NB-3.5 yrs	---
21*	box	1.75 yrs	NB-3.5 yrs	---
22	cask	40 yrs	35-45 yrs	?
23	cask	31 yrs	30-32 yrs	F
24	cask	18.5 yrs	18-19 yrs	F
25	cask	A	?	?
26	cask	18.5 yrs	18-19 yrs	F
27	box	0 yrs	fetal-6 mos	---
28	box	4 yrs	3-5 yrs	---
29*	box	1.75 yrs	NB-3.5 yrs	---
30	box	17.5 yrs	17-18 yrs	F
31*	box	1.75 yrs	NB-3.5 yrs	---
32	box	5.5 yrs	4.5-6.5 yrs	---
33	box	2.5 yrs	1.5-3.5 yrs	---
34	box	2.5 yrs	1.5-3.5 yrs	---
35	box	2.5 yrs	1.5-3.5 yrs	---
36	box	3 yrs	2-4 yrs	---
37	box	1.5 yrs	1-2 yrs	---
38	box	3 yrs	2-4 yrs	---
39	rock	?	?	?
40	box	45+ yrs	?	F
		4 yrs	3.5-4.5 yrs	---
41	box	4 yrs	2.5-5.5 yrs	---

Table 1 - continued

Kekerten Burial Inventory

Grave #	Type	Age	Range	Sex
43	box	27.5 yrs	25-30 yrs	M
44*	box	A?	?	?
45	box	25 yrs	?	F
46	box	25.5 yrs	21-30 yrs	F
47	box	4 yrs	2.5-5.5 yrs	---
48	cask	?	?	?
49	box	3 mos	NB-6 mos	---
50	box	25 yrs	?	M
51	box	5.5 yrs	4.5-6.5 yrs	---
53	box	3 mos	NB-6 mos	---
54	box	A	?	?
55*	box	A?	?	?
56	rock	32 yrs	23-39 yrs	F
57	box	3 yrs	2-4 yrs	---
58	rock	A	?	F
59	box	25 yrs	?	F
60	box	30 yrs	25-35 yrs	M
61	box	26 yrs	23-28 yrs	M
62	box	30 yrs	25-35 yrs	F
63	cask	A	?	?
64	cask	29.5 yrs	29-30 yrs	M
65	box	A	?	M?
66	cask	55.7 yrs	52-59 yrs	F
67	box	26 yrs	23-28 yrs	M
68	box	13 yrs	12.5-13.5 yrs	---
69	cask	?	?	?
70	box	A	?	?
71	cask	40 yrs	35-45 yrs	?
72	cask	21 yrs	17-25 yrs	F
73	box	36.9 yrs	30-47 yrs	F
74	box	2.5 yrs	1.5-3.5 yrs	---
76	rock	29 yrs	23-39 yrs	M
78	box	A	?	F?
79	rock	?	?	?
80	rock	?	?	?
81	box	55.7 yrs	52-59 yrs	F
82	rock	21 yrs	17-25 yrs	?
83	rock	29 yrs	23-39 yrs	M
84	rock	21 yrs	17-25 yrs	?
85	box	0 yrs	fetal	---
86	box	0 yrs	fetal	---
87	cask	A	?	?
88	rock	3 yrs	2-4 yrs	---

Table 1 - continued

Kekerten Burial Inventory

Grave #	Type	Age	Range	Sex
89	rock	A	?	?

* coffin nailed shut-age estimated based on length of box
** All fetal specimens were assigned an age of 0 yrs for calculation of sample mean age at death.
NB=Newborn
Note: Graves #42, #52, #75 and #77 have been determined not to be burials.

surrounded by a number of peripheral graves, some of which were located at quite a distance from the site. Few of the graves, if any, were located in areas of settlement activity (Stevenson 1984: 108).

Examination of the distribution of graves revealed no distinct pattern in the placement of adults vs. children, nor in the placement of males vs. females. This observation is substantiated by a remark from one of the elders that the deceased were placed anywhere, regardless of their age or sex (Quatsook, personal communication 1987). However, historical records suggest that the graves of related individuals may have been placed in close proximity to one another. During his stay at Kekerten in 1884, Boas recorded that shortly before her death, a young girl asked to be buried next to her mother, who had died the previous fall (Cole 1983: 38). At Kekerten there are two instances in which graves of older

females are located beside those of children, one of whom may be the child referred to by Boas.

Over 50% of the graves were badly disturbed. Many of the box and cask graves were torn apart and the bones scattered over the ground surface. The rock graves, on the other hand, appeared to be intact. Hantzsch (1977:19) noted that the wooden coffins on Blacklead Island, another whaling station in Cumberland Sound, were often broken apart by dogs. It is very likely, then, that dogs as well as other mammals were responsible for the disturbed condition of many of the graves at Kekerten. Human activity also contributed to the damaging of the graves. Children often tore apart the cask graves to obtain wood for their bows and arrows (Etooangat, personal communication, cited in Stevenson 1984: 119).

Most of the box graves were constructed out of wooden planks from ships or buildings put up on the site; however, a seaman's chest (see Plate 2), two rifle boxes (see Plate 3), and several food crates were also used as burial containers. The casks used for burial of the deceased (see Plate 4) were identical to those used by the whalemen for storage and transport of seal and whale oil and blubber, and furs. Considering the fact that wood was a rare commodity at Kekerten throughout most of the

whaling period (Stevenson 1984: 116), it is interesting to note that much of it was used for burial of the deceased.

With the exception of two graves and possibly a number of other graves that were completely sealed shut, thereby making observation of their contents impossible, all of the graves located at Kekerten contained the remains of only one individual. The exceptions noted were a large rock grave (Grave #2) containing the remains of at least three individuals (see Plate 5), one of them a 7-8 month old fetus, and a box grave (Grave #40) containing the skeleton of an elderly female and six bones belonging to a child approximately 4 years of age. In the latter case, the child's bones were securely buried in a thick layer of moss and appear to have been inside the grave for quite some time. While the bones may have ended up in this grave through some taphonomic process, the possibility that this child was originally buried with the female cannot be entirely discounted.

In the majority of cases, the bodies appear to have been buried in an extended position. This observation is based largely on the size and shape of the structure in which the body was placed and not on the bones themselves since these were often too disturbed to make determination of body position from them possible. In a number of instances however, some of the limb bones were still

articulated and their position indicated an extended burial. The boxes were, in most cases, built to extend the full length of the body, while some of the cask graves consisted of two casks placed together in order that the body could be laid in an outstretched position.

A number of box and cask graves were found to contain flexed or semiflexed burials. The significance of the burial of some individuals in the flexed position and others in the extended position is unknown; however, given the rarity of wood at the station, this difference may reflect the availability of material from which the burial containers were constructed at the time of death.

Unfortunately, time did not permit a thorough examination of each grave for associated artifacts; however, in the sample of forty graves analyzed in detail, very few grave goods and non-human skeletal remains were found. This appeared to be the case for the remaining 45 graves as well. The most common artifacts found in association with the skeletons were buttons and pieces of fabric, probably representing part of the original clothing of the deceased, pieces of rusted metal from unidentifiable objects, and fragments of glass. The small amount of faunal material that was present consisted primarily of seal and whale bone.

Three explanations for the lack of grave goods may be proposed: 1) the inhabitants of Kekerten did not bury many artifacts with the deceased during this time period (1857 to 1925); 2) artifacts were buried with the deceased but were later removed and reused by inhabitants at the site; or 3) grave goods were originally present but have become dispersed and lost over time. This last explanation seems the most likely in view of the high degree of disturbance of many of the graves; however, there appears to be another reason as well. One of the last surviving occupants of Kekerten reported that following the arrival of missionaries to Kekerten just before the turn of the century, the practice of placing grave goods with the deceased was stopped (Stevenson, personal communication 1987).

The cask and box graves located at Kekerten are believed to date from sometime during the occupation of the station, ie. 1857-1925. Some of the rock graves also appear to date from this time period as evidenced by the presence of historic artifacts within them. While the rock cairn burial was the traditional form of burial of the Cumberland Sound Inuit in prehistoric times, Boas reported the incident of an old woman being buried alive under a pile of rocks at Kekerten in 1885 (1964: 261),

indicating that this type of burial continued to be used until at least the late nineteenth century.

Time did not permit a more thorough examination of other rock graves for the presence of historic artifacts; however, given the fairly close proximity of most of these graves to the whaling station, as well as the absence of earlier habitation structures around them, it is likely that these graves also date from sometime between 1857 and 1925. Nevertheless, the possibility that they represent earlier burials cannot be entirely discounted.

Unfortunately, an exact date of burial could not be assigned to any of the graves; however, an earliest possible date of burial was indicated in some cases by associated artifacts or by the presence of writing on the burial containers. Square or cut nails, used throughout the nineteenth century, and round-shafted, steel-wire nails, which appeared with regularity in the latter quarter of the nineteenth century (Hume 1969: 254) were used in the construction of the box graves, indicating that these graves span the period of transition from cut to wire nails. Two rifle boxes used for burial of the deceased had writing on the outside, indicating the years 1892 and 1897 respectively to be the earliest possible dates of burial for these particular individuals. Finally, two rifle cartridges found in the graves of two

adults were 303 calibre cartridges, a type first manufactured in 1888 (Dynes 1979: 4).

The Kekerten graves contained the remains of 87 individuals of which 46 were adults (aged 18 years and over), 2 were probably adults (the coffins were nailed shut but their length suggested burial of an adult), 2 were adolescents (aged 12 to 18 years), 24 were children (aged 1 to 12 years), 7 were infants or fetuses (below 1 year of age), and 6 were classified as age unknown. The sex distribution of the adults was as follows: 12 males, 16 females, 1 probable male, 2 probable females, and 15 of unknown sex. While it appears initially that more females than males are represented in the graves, the high number of adults for which sex could not be determined makes it impossible to draw any conclusions regarding the sex distribution of the adults.

Below are descriptions for each of the 40 sample graves analyzed over the two field seasons. Included in each description are the skeletal elements, associated artifacts and faunal material found in each grave, and an outline of the techniques used to determine the sex and age at death of each individual.

Individual #1

This is an adult female. The skeleton was represented by the skull minus the mandible, most of the vertebrae and ribs, the sternum, the clavicles, the upper limb bones with the exception of the left humerus, the right pelvic bone and femur, the tibiae and some of the hand and foot bones. Some of the remains had fallen out of one end of this cask grave, but the majority of the bones were located inside the cask. Most of the bones had become mixed together with the exception of a number of vertebrae, ribs and upper limb bones which were still articulated. Two fragments of green glass and an epiphysis from the body of a whale vertebra were found with the remains.

The sex of this individual was determined to be female based on the maximum head diameter of the femur (Stewart 1979), the circumference of the tibia (Iscan and Miller-Shaivitz 1984), and the characteristic female features of the pelvic bone, including the wide sciatic notch and the presence of a subpubic concavity (Phenice 1969).

Attrition of the maxillary molars yielded an age estimate of 17 to 25 years (Brothwell 1981). The third molars had erupted and the spheno-occipital synchondrosis

had fused. Examination of the right pubic symphysis produced the following results based on the model developed by Gilbert and McKern (1973):

Component I=2
Component II=2
Component III=2
6 = 29.62 years ± 4.43

Since the pubic symphysis is a more reliable age indicator than dental attrition, this individual was assigned an age estimate of 29.6 years with a possible range of 25 to 36 years.

Individual #4

This is a young adult male. The skeleton was fairly complete with the exception of the mandible, several vertebrae, the manubrium, the humeri, a number of ribs, the patellae, and some of the hand and foot bones. The grave had been quite disturbed and only two vertebrae and a few hand and foot bones were still in articulation. Associated with the burial were pieces of fabric, a button, and half of a seal mandible.

Cranial discriminant function analysis produced values indicative of a male (Giles and Elliot 1963, Hanihara 1959) (see Appendix E). The pelvic bones were characterized by the presence of a shallow sciatic notch, and the absence of a subpubic concavity, a ventral arc and a median ridge, all clearly male features (Phenice 1969).

Several metric observations, including femoral shaft circumference (Black 1978) and mesosternum length (Jit et al. 1980) supported the designation of this individual as male.

Analysis of the pubic symphysis using the model developed by McKern and Stewart (1957) yielded the following results:

Component I=1
Component II=0
Component III=0
1 = 19.04 years ± .79

The third molars had erupted and the spheno-occipital synchondrosis had fused. The degree of attrition observed on the maxillary molars fell into the 17 to 25 year category (Brothwell 1981). The epiphyses on the vertebral bodies, the iliac crest, the distal ulnae and the distal radius had not yet completely fused. Johnston (1962) notes that the latter three epiphyses begin to fuse in males at 18.5 years . Therefore the age of this individual was estimated at 19 years with a possible range of 18.5 to 20 years.

Individual #7

This is an adult of indeterminate sex. The skeleton was poorly represented, the remains consisting solely of the larger cranial bones, two vertebrae, the scapulae,

three ribs, a right radius, the femora, the left tibia, one fibula and one unidentifiable metacarpal or metatarsal. The elements were very disturbed, having been scattered downslope from the grave. No bones remained inside the cask and no artifacts or faunal remains were found.

The paucity of skeletal remains prevented an accurate assessment of the sex of this individual. Two metric observations, the shaft circumference of the femur and the glenoid cavity length of the scapula indicated a male (Black 1978, Stewart 1979), while the maximum head diameter of the femur fell into the female category (Stewart 1979). This latter observation was supported by the presence of female features in the calvarium, specifically small supraorbital brow ridges and smooth muscle markings. Finally, measurement of the circumference of the tibia yielded a value which fell on the border between the male and female ranges (Iscan and Miller-Shaivitz 1984).

Complete fusion of the epiphyses of the vertebrae, scapulae, ribs, and the long bones present indicated that this individual was an adult; however, the lack of dentition and pelvic bones prevented the assignment of a more specific age estimate.

Individual #11

This is an adult male. The skeleton was quite complete, lacking only the sacrum, the right scapula and clavicle, the left radius, the ribs, the right femur and fibula, and the patellae and tibiae. The grave had been somewhat disturbed; however, the right upper limb bones and most of the toe bones were still in articulation. Several small fragments of blue glass, six buttons, a bird bone, pieces of fabric, and a knitted glove were found with the remains.

The pelvic bones were characterized by a narrow sciatic notch, and the absence of a subpubic concavity, a median ridge and a ventral arc, indicating a male (Phenice 1969). Discriminant function analysis of both the cranium and the mandible supported this observation (Giles and Elliot 1963, Hanihara 1959, Giles 1964). The designation of this individual as male was further substantiated by several metric observations, including mesosternum length (Jit et al. 1980), maximum length of the talus (Steele 1976) and glenoid length of the scapula (Stewart 1979).

The maxillary first molars exhibited severe wear, indicating an age of 45 plus years (Brothwell 1981). The Todd (1920) method of pubic symphysis aging produced an estimate of 50 plus years based on observation of an

eroded symphyseal face, erratic ossification and breakdown of the ventral border. Since the pubic symphysis is a more reliable age indicator than dental attrition, this individual was assigned an age estimate of 50 plus years.

Individual #12

This is an adult female. The skeleton was very complete, lacking only four ribs, the left pelvic bone, the tibiae, two carpal bones, and some phalanges. The burial had undergone little disturbance and many of the bones were still in their original position. Pieces of metal and fabric were found with the remains.

Discriminant function analysis of both the cranium and mandible produced values that fell within the male range (Giles and Elliot 1963, Hanihara 1959, Giles 1964). The shaft circumference of the femur was in agreement with this observation (Black 1978). The pelvic bone, on the other hand, although missing the pubic symphysis, possessed a large sciatic notch, a clearly female trait. Since the pelvic bone is the most reliable indicator of sex in the human skeleton, this individual was designated as female.

The pubic symphyses were absent and therefore could not be used for estimating the age at death of this individual. The mandibular molars exhibited severe

attrition, falling into the 45 plus age range (Brothwell 1981). Cranial suture closure, although considered a very unreliable indicator of age, was used as a crosscheck. Ectocranially, the coronal suture was almost completely obliterated, the lambdoidal suture was half obliterated, and the sagittal suture had completely disappeared, indicating an older individual. Based on the degree of dental attrition observed, this individual was assigned an age estimate of 45 plus years.

Individual #15

This is an adult of indeterminate sex. The skeletal remains consisted of seven vertebrae, the sternum, the clavicles, the ulnae, the right humerus, radius, femur and tibia, the left patella, the mandibular central incisors, and a number of ribs and hand and foot bones. The grave had been greatly disturbed and no bones remained in articulation. One seal bone and two caribou bones were found within the grave.

The femoral shaft circumference (Black 1978) and the maximum head diameter of the humerus (Stewart 1979) fell within the female range, while the tibia shaft circumference fell into the male range (Iscan and Miller-Shaivitz 1984). The mesosternum length was on the border between the male and female ranges (Jit et al 1980).

All epiphyses appear to have fused, indicating that this individual was an adult; however, the absence of the pelvic bones and dentition prevented the assignment of a more specific age estimate.

Individual #16

This is a child of indeterminate sex. The skeleton was relatively complete, lacking only the skull, the atlas vertebra, the mesosternum, the right femur, the left patella and tibia, and some of the hand and foot elements. Most of the ribs appeared to be in their original position, while the rest of the skeleton had been disturbed. A dog skull was found inside the grave at the south end. Also associated with the remains were three halves of two pocket knife handles, several clay pipe stem fragments, and pieces of fabric.

Diaphyseal length of the left femur, the left tibia, and the fibulae, as well as the maximum width of the left ilium yielded an age estimate of 7.5 to 8.5 years (Merchant and Ubelaker 1977) (see Appendix F). A slightly lower age estimate of 6.5 to 7.5 years was indicated by the diaphyseal length of the left humerus, while an even lower estimate of 5.5 to 6.5 years was obtained for the diaphyseal length of the left radius and the left ulna (Merchant and Ubelaker 1977). Finally, diaphyseal lengths

of the right humerus and the right ilium yielded an age estimate of 6.5 to 8.5 years (Merchant and Ubelaker 1978). The ischium and pubis had fused together, indicating a minimum age of 7 years (Bass 1971: 148). Based on these observations, the age of this individual was estimated at 7.75 years with a possible range of 7 to 8.5 years.

Individual #17

This is a child of indeterminate sex. The skeleton was fairly incomplete, lacking the skull, many of the vertebrae, the sternum, the scapulae, most of the ribs, the humeri, one ulna and patella, and all but three of the hand and foot elements. The bones had become intermingled. A small fragment of purple glass and blue glass, a wooden stopper belonging to the cask, a long piece of wood, a button, several pieces of metal and cloth, a fragment of the shaft of a whale rib and an unidentifiable faunal bone were found in this grave.

Measurement of the diaphyseal lengths of the right tibia, the right femur and a fibula (side unknown) yielded age ranges of 7.5 to 8.5 years, 5.5 to 7.5 years and 6.5 to 7.5 years respectively (Merchant and Ubelaker 1977). The maximum width of the left ilium fell into the 5.5 to 6.5 year range (Merchant and Ubelaker 1977).

Therefore the age of this child was estimated at 7 years with a possible range of 5.5 to 8.5 years.

Individual #18

This is a child of indeterminate sex. The skeleton was relatively complete with the exception of seven vertebrae, the sternum, the right clavicle, two ribs, the patellae, the left pubic bone, and a number of hand and foot bones. Although some disturbance of the grave had occurred, many of the bones were still in their original position. A piece of clear mica, a large fragment of metal, a number of smaller pieces of metal and fabric, a caribou bone and a seal bone were found in the grave.

Diaphyseal length of the femora, the tibiae and the fibulae yielded an age estimate of 2.5 to 4.5 years, while a slightly lower age estimate of 2.5 to 3.5 years was obtained from measurement of the right humerus diaphysis (Merchant and Ubelaker 1977). The maximum width of the left and right ilia indicated an age of 2.5 to 5.5 years (Merchant and Ubelaker 1977). Eruption of the maxillary and mandibular teeth corresponded with the slightly higher age estimate of 6 years plus or minus 24 months (Ubelaker 1978). Given the fact that tooth eruption is a more accurate indicator of chronological age than diaphyseal length (Ubelaker 1978: 46), the latter age estimates are

likely more representative of the true age of this individual. This conclusion is substantiated by the fact that the ischium and pubis were fused, an event known to occur in the 7th to 8th year (Bass 1971); and almost all of the vertebral arches had fused to the centra, indicating an age estimate at the higher end of the 3 to 7 year range (Bass 1971). Therefore an age estimate of 7.5 years with a possible range of 7 to 8 years is suggested for this individual.

Individual #22

This is an adult of indeterminate sex. The skeleton was relatively incomplete, lacking the skull, several vertebrae, the manubrium, the scapulae, a number of ribs, the humeri, the right ulna, the innominates, the right femur, the right patella, the left fibula, and many of the hand and foot bones. The grave had been greatly disturbed and most of the remains were intermingled; however, the right fibula and several tarsal bones appeared to be in their original position. Associated with the burial were pieces of brown cloth, a rifle cartridge, metal fragments, a metal button, and an unidentifiable glass object. No faunal remains were found.

This individual could not be sexed due to the absence of the skull, pelvic bones, scapulae and many of the long bones. The length of the mesosternum fell within the male range (Jit et al. 1980), while the circumference of the left tibia indicated a female (Iscan and Miller-Shaivitz 1984).

A loose mandibular first molar exhibited heavy attrition indicating an age of 35 to 45 years (Brothwell 1981). Stage 2 osteophytosis on the eleventh and twelfth thoracic vertebrae also suggested an older individual (Stewart 1958). Based on the degree of dental attrition observed, an age of 40 years with a possible range of 35 to 45 years was assigned to this individual.

Individual #23

This is an adult female. The skeleton was fairly complete with the exception of the skull, a number of vertebrae and ribs, the sacrum, the manubrium, the left clavicle, the right radius, and a number of hand and foot bones. The grave had been somewhat disturbed, with a few bones scattered under rocks at the eastern end, and a couple of ribs, an ulna, and a pelvic bone found at the western end. The bones of both lower legs were articulated. A wooden button, several fragments of metal,

and a large, unidentifiable piece of whale bone were found within the grave.

A wide sciatic notch, a subpubic concavity and a ventral arc, features indicative of a female (Phenice 1969), were present on the pelvic bones. Values obtained from the ischium-pubis index (Washburn 1948) and the pubic index (Miles 1986) also fell within the female range. Several metric observations, including glenoid length of the scapula (Stewart 1979), maximum head diameter of the humerus (Stewart 1979), and circumference of the tibia (Iscan and Miller-Shaivitz 1984) supported this conclusion.

The degree of wear on three single molars, one mandibular and two maxillary molars was moderate, indicating an age of 25 to 35 years (Brothwell 1981). Analysis of the right pubic symphysis using the standards of Gilbert and McKern (1973) revealed the following results:

Component I=2
Component II=2
Component III=3
7 = 32.00 years ± 4.55

The very close overlap of the two age ranges suggests that this individual was approximately 31 years of age with a possible range of 30 to 32 years.

Individual #24

This is a young adult female. The skeletal remains consisted of the skull minus the mandible, ten vertebrae, the mesosternum, the scapulae, fifteen ribs, the left humerus, the radii and ulnae, the right femur and tibia, the patellae and fibulae, three single teeth and a number of hand and foot bones. The grave had been very disturbed and the bones had become mixed together. A piece of green glass, one shell button, pieces of metal, and two seal bones were found with the burial.

The skull possessed blunt supraorbital margins and a large palate, both male features, and small mastoid processes and supraorbital ridges, both female features (Bass 1971). However, the femoral shaft circumference (Black 1978), the tibia shaft circumference (Iscan and Miller-Shaivitz 1984), the glenoid length of the scapula (Stewart 1979) and the maximum head diameter of the femur (Stewart 1979) were clearly female, falling into the lower end of the female ranges.

The third molars had erupted and the maxillary teeth showed wear facets but no exposed dentin, indicating an age range of 17 to 25 years (Brothwell 1981). The epiphyses of the distal ulnae had fused; however, an epiphyseal line was still visible. According to Johnston

(1962), union of the distal epiphysis of the ulna commences in females at the age of 18 and is complete by the age of 19 years. The proximal epiphysis of the tibia and the distal epiphysis of the femur had fused, indicating a minimum age of 18 years (Johnston 1962). Based on the degree of epiphyseal union of these long bones, this individual was assigned an age estimate of 18.5 years with a possible range of 18 to 19 years.

Individual #26

This is a young adult female. The skeleton was complete except for one rib, the right humerus, and some of the hand and foot bones. The burial was relatively undisturbed, with most of the elements, particularly those of the upper body, still articulated. A seal axis, some metal, and part of what appears to have been a sealskin boot were found with the remains.

Discriminant function analysis of the cranium and mandible yielded values indicative of a female (Giles and Elliot 1963, Giles 1964). The ischium-pubis index (Washburn 1948) and the pubic index (Miles 1986) also fell into the female range. This conclusion was supported by several other metric observations, including circumference of the tibia (Iscan and Miller-Shaivitz 1984), maximum head diameter of the femur (Stewart 1979), length of the

manubrium and mesosternum (Jit et al. 1980), and maximum head diameter of the humerus (Stewart 1979).

The right pubic symphysis was present and yielded the following results based on the standards of Gilbert and McKern (1973):

Component I=0
Component II=1
Component III=0
1 = 19.80 years ± 2.62

The third molars were erupted and the spheno-occipital synchondrosis was fused. Attrition of the maxillary and mandibular molars was slight, falling into the 17 to 25 year age category (Brothwell 1981). The epiphyses of the proximal fibula, the distal ulna, the iliac crest and the proximal humerus were not yet completely fused. Johnston (1962) states that epiphyseal union of the proximal fibula begins at 16 years in the female and is completed by 19 years, while union of the distal ulna begins at 18 years and is completed by 19 years. Fusion of the iliac crest epiphysis commences at 17.5 years, while fusion of the proximal humerus begins at 16 years (Johnston 1962). Therefore, based on the degree of epiphyseal union observed in the fibula and ulna, the age of this individual was estimated at approximately 18.5 years with a possible range of 18 to 19 years.

Individual #28

This is a child of indeterminate sex. The skeleton was represented by the mandible, most of the vertebrae, the clavicles, the left scapula, all of the upper limb bones, the left ilium, both pubic bones, the right ischium, the femora, the tibiae, the fibulae, seventeen ribs, four single teeth, eleven unidentifiable hand and foot bones, and seven other unidentifiable bones. The grave had been quite disturbed and no bones remained in articulation. Pieces of fabric and metal were the only artifacts found with the skeletal elements.

Diaphyseal length of the femora, the right tibia, and the right ulna yielded an age estimate of 2.5 to 4.5 years, while the diaphyseal length of the humeri and right radius fell into the 2.5 to 3.5 year age range (Merchant and Ubelaker 1977). The maximum width of the left ilium and the diaphsyeal length of the left tibia yielded an age estimate of 2.5 to 5.5 years (Merchant and Ubelaker 1977). Eruption of the mandibular teeth corresponded to an age estimate of 4 years plus or minus 12 months (Ubelaker 1978). Since tooth eruption is a more accurate indicator of age than diaphyseal length (Ubelaker 1978: 46), this individual was assigned an age estimate of 4 years with a possible range of 3 to 5 years.

Individual #32

This is a child of indeterminate sex. The skeleton was represented by only six vertebrae, six ribs, one fibula (side unknown), four unidentifiable metacarpals or metatarsals, three unidentifiable epiphyses, and a few other bone fragments. The grave had been very disturbed and the bones had become jumbled together. Pieces of fabric and metal, one shell button, and two seal bones were found in the grave.

Only one diaphyseal length, the fibula (side unknown) could be measured and it yielded an age estimate of 4.5 to 6.5 years (Merchant and Ubelaker 1977). The arches of the thoracic vertebrae had not yet fused to the centra, indicating an age of less than 7 years (Bass 1971: 77). Therefore, the age of this individual was estimated at 5.5 years with a possible range of 4.5 to 6.5 years.

Individual #33

This is a child of indeterminate sex. The skeletal remains consisted of the basal part of the occipital bone, fifteen vertebrae, the scapulae, the clavicles, all of the upper limb bones, the right ilium and ischium, fifteen ribs, eleven unidentifiable hand and foot bones, ten other unidentifiable bones, and four single teeth. The grave

had been greatly disturbed and none of the bones were in articulation. Associated with the burial were pieces of metal and fabric and one faunal (whale?) bone.

An age estimate of 1.5 to 3.5 years was indicated by the diaphyseal length of the humeri and the right ulna, and by the maximum width of the right ilium (Merchant and Ubelaker 1977). The diaphyseal length of the right radius yielded a slightly lower age estimate of 6 months to 2.5 years (Merchant and Ubelaker 1977); however, given the fact that three of the diaphyses yielded the same age estimate, the age of this individual was estimated at 2.5 years with a possible range of 1.5 to 3.5 years.

Individual #34

This is a child of indeterminate sex. The skeleton was missing the skull, some vertebrae, the sternum, the left scapula and left upper limb bones, several ribs, the right femur, the patellae and most of the hand and foot bones. The remains had become mixed together inside this box grave. Twenty-seven buttons and a piece of mica were present, but no faunal remains were observed.

Measurement of the diaphyseal lengths of the right humerus, the right tibia, the right ulna, the left femur, and the maximum width of the left ilium yielded values which fell into the 1.5 to 3.5 year range (Merchant and

Ubelaker 1977). Therefore this child was aged approximately 2.5 years with a possible range of 1.5 to 3.5 years.

Individual #35

This is a child of indeterminate sex. The skeletal remains consisted of a few of the larger cranial bones, most of the vertebrae and ribs, the left scapula, the radii, the ulnae, the left humerus, the femora, a right ilium, an ischium, the pubic bones, the right tibia, four loose teeth and some hand and foot bones. The remains were fairly intact inside this box grave, with nine thoracic vertebrae, a left scapula and a number of ribs in articulation. Associated with the remains were a few nails, several pieces of metal and cloth and an unidentifiable faunal bone.

Diaphyseal lengths of the right femur, left humerus, right tibia and left and right ulnae, and the maximum width of the right ilium yielded an age of 1.5 to 3.5 years (Merchant and Ubelaker 1977). A slightly younger age of 6 months to 2.5 years was obtained from the diaphyseal length of the left radius (Merchant and Ubelaker 1977). Based on the measurement of the other four limb bones and the ilium, however, the age of this

child was estimated at 2.5 years with a possible range of 1.5 to 3.5 years.

Individual #36

This is a child of indeterminate sex. The skeleton was very complete, lacking only the sternum, the right ilium and pubic bone, and perhaps some of the hand and foot bones (these could not be identified). The grave had undergone very little disturbance and most of the bones were still in their original position. A piece of what appears to be animal fur was wrapped around the right humerus. No faunal remains were found in the grave.

Diaphyseal lengths of the femora, the tibiae, the right humerus, the right ulna, and the right radius all yielded an age estimate of 1.5 to 3.5 years (Merchant and Ubelaker 1977). The age estimate indicated by the maximum width of the left ilium was in agreement with that produced by measurement of the diaphyses. Finally eruption of the maxillary and mandibular teeth yielded an age estimate of 3 years plus or minus 12 months (Ubelaker 1978). Since tooth eruption is a more accurate age indicator than diaphyseal length (Ubelaker 1978: 46), this individual was assigned an age estimate of 3 years with a possible range of 2 to 4 years.

Individual #37

This is a child of indeterminate sex. The skeleton was relatively complete, lacking only the frontal bone and some of the smaller facial bones of the cranium, the sternum, some vertebrae and ribs, several upper limb bones, the fibulae, the patellae, and a number of hand and foot bones. Three buttons, some cloth and a number of nails were found with this burial, but no faunal remains were observed.

Only diaphyseal lengths of the right and left femora and the left tibia were measurable and yielded an age of NB (newborn) to 1.5 years, 6 months to 1.5 years, and NB to 1.5 years respectively (Merchant and Ubelaker 1977). These ages were compared with those obtained using Johnston's (1962) standards (6 months to 1.5 years for all three bones). An age of 18 months plus or minus 6 months was obtained based on eruption of the mandibular dentition (Ubelaker 1978). Since tooth eruption is a more accurate indicator of chronological age than diaphyseal length (Ubelaker 1978: 46), an age estimate of 1.5 years with a possible range of 1 to 2 years was assigned to this individual.

Individual #38

This is a child of indeterminate sex. The skeleton was represented by the skull minus the mandible, approximately one half of the vertebrae, the scapulae and clavicles, a number of ribs, the left radius, the ilia, the left ischium and pubis, and a few hand and foot bones. The grave was greatly disturbed and part of the skull of this individual was located a fair distance away. With the exception of two nails, no artifacts or faunal remains were found.

Diaphyseal length of the left radius indicated an age of 4.5 to 5.5 years (Merchant and Ubelaker 1977). A slightly larger age range of 4.5 to 6.5 years was obtained by measurement of the maximum width of the left ilium (Merchant and Ubelaker 1977). The presence of the maxilla allowed for the determination of age based on tooth eruption. Using Ubelaker's (1978) standards, an age of 3 years plus or minus 12 months was obtained. Given the fact that tooth eruption is a more reliable indicator of age than diaphyseal length (Ubelaker 1978: 46), an age estimate of 3 years with a possible range of 2 to 4 years was assigned to this individual.

Individual #40

This is an adult female. The skeleton was fairly complete with the exception of two lumbar vertebrae, the sacrum, the mesosternum, the right scapula, the left humerus and ulna, nine ribs, the left pelvic bone and fibula, and a number of hand and foot bones. A right femur and talus and four hand bones, all belonging to a child approximately 4 years of age, were found in this grave. The grave had been somewhat disturbed; however, the cervical vertebrae, six thoracic vertebrae, the right upper limb bones and the left and right hand bones were still in articulation. A feather and some fabric were found with the remains.

Female features, specifically a wide sciatic notch, a subpubic concavity and a ventral arc, characterized the pelvic bones (Phenice 1969). In addition, discriminant function analysis of the mandible (Giles 1964) and the femur (Stewart 1979), as well as the shaft circumference of the femur (Black 1978), the maximum head diameter of the femur (Stewart 1979) and the shaft circumference of the tibia (Iscan and Miller-Shaivitz 1984) indicated a female.

The pubic symphysis was damaged and therefore could not be used for aging. The left maxillary second molar

exhibited severe attrition, indicating an age of 45 plus years (Brothwell 1981). Cranial suture closure also indicated an older individual. Ectocranially, the sagittal and lambdoidal sutures were half obliterated, while the coronal suture was completely obliterated. Based on the degree of dental attrition observed, the age of this individual was estimated at 45 plus years.

Individual #41

This is a child of indeterminate sex. The skeletal remains consisted of twelve vertebrae, the right scapula, the clavicles, 14 ribs, one humerus, the ischia, one left ilium and pubis, a left tibia, two incisors, 3 bones which appear to be metacarpals, seven phalanges, and one right calcaneus. The top of this box grave had been removed and the bones inside had become mixed together. Two seal bones, one a phalanx and the other a long bone, possibly a tibia, were present, but no artifacts were found in the grave.

Only the diaphyseal length of the left tibia could be measured (see Appendix E) and it provided an age estimate of 2.5 to 4.5 years (Merchant and Ubelaker 1977). The only other long bone present, a humerus, was damaged and therefore could not be used to estimate age. The maximum width of the left ilium fell into the 4.5 to 5.5 years

category (Merchant and Ubelaker 1977). Therefore this individual was assigned an age estimate of 4 years with a possible range of 2.5 to 5.5 years.

Individual #43

This is an adult male. The skeleton was fairly complete, lacking only the left scapula and innominate, the right femur, the patellae, six ribs, slightly less than half of the vertebrae, and a number of hand and foot bones. Most of the bones had been disturbed; however, the left tibia, fibula and a number of toe bones were still articulated. A black wooden pocket knife handle, some dark brown cloth and a mammal vertebra (species unknown) were found with the remains.

Discriminant function analysis of both the cranium and the mandible produced values that fell within the male range (Giles and Elliot 1963, Giles 1964). The right pelvic bone, although extensively damaged, was characterized by a narrow sciatic notch, indicating a male. Several other metric observations, including discriminant function analysis of the femur (Stewart 1979), shaft circumference of the femur (Black 1978), maximum head diameter of the femur (Stewart 1979), and circumference of the tibia (Iscan and Miller-Shaivitz

1984) also supported the conclusion that this individual is male.

Damage to the pubic symphysis prevented the use of this feature to determine age. Examination of the maxillary and mandibular first molars revealed slight to moderate exposure of dentin, falling into the 25 to 35 year range (Brothwell 1981). The second and third maxillary and mandibular molars were absent; however, the degree of wear on all four premolars was slight with no dentin exposed, suggesting that the age of this individual is closer to the lower end of the age range indicated by the first molars. An age estimate of 27.5 years with a possible range of 25 to 30 years was therefore assigned to this individual.

Individual #45

This is an adult female. The skeleton was represented by the skull, approximately half of the vertebrae, the right scapula, the left clavicle, a number of ribs and hand and foot bones, the left radius, ulna, pelvic bone, femur and patella, one fibula, and a loose right maxillary lateral incisor. Many of the bones were in poor condition, some being wet and covered with moss and lichen, and others showing surface exfoliation due to weathering. The grave had been disturbed and the bones

had been scattered. With the exception of a few nails, no artifacts or faunal remains were found with this burial.

The skull was characterized by sharp supraorbital margins, a small palate and smooth muscle markings, all indicative of a female. The pubic symphysis of the left pelvic bone was damaged, therefore preventing observation of several features indicative of the individual's sex; however, the wide sciatic notch and the small acetabulum supported the designation of the skeleton as female. A discriminant function analysis of the mandible (Giles 1964) and measurement of the maximum head diameter of the left femur (Stewart 1979) substantiated this conclusion.

The third molars had erupted and the spheno-occipital synchondrosis, although damaged, appeared to have fused. The pubic symphysis was damaged and therefore could not be used for aging. All four maxillary molars present showed wear facets only, with no dentin exposed, while the mandibular first molars were characterized by very small areas of dentin exposure and the second and third molars by wear facets only, indicating an age of 17 to 25 years (Brothwell 1981). The sternal end of the remaining clavicle was damaged; however, the epiphyses of the heads of the ribs and the bodies of the vertebrae had fused, indicating a minimum age of approximately 25 years (Bass

1971). Therefore this individual was assigned an age estimate of 25 years.

Individual #47

This is a child of indeterminate sex. The skeletal remains consisted of the basal part of the occipital bone, twelve vertebrae, the scapulae, the left clavicle and tibia, the humeri, the right radius and ulna, the pelvic bones, the femora, the fibulae, fifteen ribs, and thirty-eight hand and foot bones. The grave had been disturbed and the bones had become mixed together. Associated with the remains were pieces of metal and fabric, a bullet, and an unidentifiable faunal bone.

The age of this individual was estimated from measurement of a number of long bone diaphyses. Diaphyseal length of the femora and the left humerus yielded an age estimate of 3.5 to 5.5 years (Merchant and Ubelaker 1977), while diaphyseal length of the fibula (side unknown), the right ulna and the right radius, produced age estimates of 2.5 to 5.5, 2.5 to 3.5 and 2.5 to 3.5 years respectively. Maximum width of the left ilium revealed a slightly higher age estimate of 4.5 to 6.5 years (Merchant and Ubelaker 1977). Based on these measurements, the age of this individual was estimated at 4 years with a possible range of 2.5 to 5.5 years.

Individual #50

This is an adult male. The skeletal remains consisted of the skull minus the mandible, six vertebrae, a left scapula, clavicle and tibia, a number of ribs and hand and foot bones, and the femora. The grave had been broken apart and the bones were scattered over the ground. A few pieces of metal and one unidentifiable faunal bone were found with the remains.

The skull was characterized by a large palate, blunt supraorbital margins, and large mastoid processes, indicating a male. This conclusion was substantiated by a discriminant function analysis of the skull (Giles and Elliot 1963). The value obtained by measuring the shaft circumference of the left femur also fell within the male range (Black 1978).

The degree of wear of the left first and second molars indicated an age of 17 to 25 years but closer to the latter end of this age range (Brothwell 1981). The third molars had erupted, and the spheno-occipital synchondrosis had fused. In addition, all epiphyses, including the sternal epiphysis of the clavicle, had fused, indicating a minimum age of 25 years (Bass 1971). Therefore the suggested age estimate for this individual is approximately 25 years.

Individual #51

This is a child of indeterminate sex. The skeleton was relatively incomplete, lacking the skull, almost half of the vertebrae, the sternum, the scapulae, the right clavicle and femur, the patellae, the tibiae, the left humerus, the radii, the ulnae, and most of the hand and foot elements. The grave had been greatly disturbed and the remains had become mixed together. No artifacts or faunal bones were found with this burial.

Diaphyseal length of the left femur, the right humerus and the fibulae yielded an age estimate of 4.5 to 6.5 years (Merchant and Ubelaker 1977). The maximum width of the right ilium indicated an age of 5.5 to 6.5 years (Merchant and Ubelaker 1977). Based on these measurements, the age of this individual was estimated at 5.5 years with a possible range of 4.5 to 6.5 years.

Individual #57

This is a child of indeterminate sex. The skeleton was represented by the skull, all of the vertebrae and ribs, the right scapula, the clavicles, the humeri, the ulnae, the right radius, the pelvic bones, the femora, the tibiae, the fibulae, and a few hand and foot bones.

Although a number of elements had been disturbed, the ribs and vertebrae were still in articulation. A knife with a wooden handle and a metal blade, and a whalebone knife handle were found in the grave.

Diaphyseal length of the femora, the tibiae and the right humerus yielded an age estimate of 1.5 to 3.5 years (Merchant and Ubelaker 1977). Eruption of the maxillary and mandibular teeth corresponded to an age estimate of 3 years plus or minus 12 months (Ubelaker 1978). Based on the more accurate age indicator, tooth eruption, an estimated age of 3 years with a possible range of 2 to 4 years was assigned to this individual.

Individual #59

This is an adult female. The skeleton was relatively complete with the exception of the mandible, the scapulae, eleven ribs, the right pelvic bone and femur, the fibulae, and a number of hand and foot bones. The grave had been disturbed and some of the bones scattered over the ground. No faunal remains were found in the grave; however, pieces of fabric and a plastic button were associated with the skeleton.

The pelvic bone was characterized by a wide sciatic notch, a subpubic concavity, a ventral arc, a median ridge and a small acetabulum, all female features (Phenice 1969,

Bass 1971). This conclusion was supported by the ischium-pubis index (Washburn 1948) and the pubic index (Miles 1986), and by a number of metric observations, including the tibia shaft circumference (Iscan and Miller-Shaivitz 1984) and the maximum head diameter of the femur (Stewart 1979).

Three small patches of dentin were exposed on the left maxillary first molar, indicating an age estimate of 17 to 25 years (Brothwell 1981). With one exception, all epiphyses, including the epiphysis of the sternal end of the clavicle and the epiphyses of the vertebral bodies had fused, indicating a minimum age of 25 years (Bass 1971). The exception was the right humerus, which was characterized by an incompletely fused proximal epiphysis. This humerus was also longer than the left humerus. Although it is possible that this bone does not belong to this individual, it did not appear to belong to any neighbouring graves either. The spheno-occipital synchondrosis had fused and the third molars had erupted. Unfortunately, the available pubic bone was weathered and covered with lichen and therefore could not be used for aging this individual. Based on the degree of dental attrition observed and on the complete fusion of the epiphyses of the clavicles and vertebrae, an age estimate of 25 years was assigned to this individual.

Individual #60

This is an adult male. The skeleton was fairly complete with the exception of the mandible, three vertebrae, the right scapula, the clavicles, one rib, the left humerus, the pelvic bones, the fibulae, and a number of hand and foot elements. The grave had been disturbed and some of the bones had been scattered over the ground. Associated with the burial were pieces of fabric and ten buttons of various sizes.

Blunt supraorbital margins, a large palate, pronounced muscle markings and large mastoid processes, all male features, characterized the skull. Cranial discriminant function analysis supported this conclusion (Giles and Elliot 1963, Hanihara 1959). Other metric observations indicative of a male included mesosternum length (Jit et al 1980), glenoid length of the scapula (Stewart 1979), shaft circumference of the femur (Black 1978) and discriminant function analysis of the femur (Stewart 1979).

Moderate patches of dentin were exposed on the maxillary first molars, indicating an age estimate of 25 to 35 years (Brothwell 1981). Since no other remains could be aged, the age of this individual was estimated at 30 years with a possible range of 25 to 35 years.

Individual #61

This is an adult male. The skeleton was quite complete with the exception of a number of vertebrae, the sacrum, five ribs, the left ulna, the right humerus, and some elements of the hands and feet. The box grave was completely torn apart and the remains were scattered over the ground. The box appeared to have been moved from its original location as evidenced by the presence of a darkened retangular area with no vegetation approximately ten feet from the present location of the grave. In this area, a piece of dark green glass and a knife 30.2 cm in length with a wooden handle and a metal blade were found. Also located on a nearby rock was a metal shackle. No faunal remains were observed.

Discriminant function analysis of the cranium and mandible produced values indicative of a male (Giles and Elliot 1963, Giles 1964). The skull was characterized by blunt supraorbital margins, fairly pronounced supraorbital ridges and fairly heavy muscle markings, while the pelvic bones had a narrow sciatic notch, no subpubic concavity and no ventral arc, all clearly male features (Bass 1971, Phenice 1969). A number of metric observations, including femur shaft circumference (Black 1978), tibia shaft circumference (Iscan and Miller-Shaivitz 1984), and

maximum head diameter of the femur (Stewart 1979), supported the designation of this individual as male.

The third molars were erupted and the degree of wear on the mandibular first molars and the maxillary first molars and right second molar fell into the 17 to 25 year age range (Brothwell 1981). Examination of the pubic symphyses using the standards of McKern and Stewart (1957) produced the following results:

Component I=4
Component II=4
Component III=2
10 = 26.05 years ± 1.87

Since the pubic symphysis is a more reliable age indicator than dental attrition, this individual was assigned an age estimate of 26 years with a possible range of 23 to 28 years.

Individual #62

This is an adult female. The skeletal remains consisted of the skull minus the mandible, a number of vertebrae, the sacrum, the clavicles, the left scapula,the left innominate, the right ulna and patella, the radii, femora, tibiae, and fibulae, 5 loose teeth, and 15 hand and foot bones. The grave had been greatly disturbed and the bones had been scattered and mixed together with the remains of Individual #61. A small ivory carving, a

stanchion from a ship, a bird bone and a seal earbone were associated with this grave.

Discriminant function analysis of the cranium yielded values indicative of a male (Giles and Elliot 1963, Hanihara 1959). Measurement of the circumference of the femur also fell within the male range (Black 1978). The circumference of the tibia, on the other hand, indicated a female (Iscan and Miller-Shaivitz 1984), while the pelvic bone, although damaged, possessed a very wide sciatic notch, a clearly female feature. The designation of this individual as female was supported by the presence of fairly sharp supraorbital margins, smooth muscle markings, and small mastoid processes of the skull (Bass 1971).

The pubic symphysis was missing and therefore could not be used to estimate the age of this individual. The degree of attrition of the maxillary first molars fell into the 25 to 35 year age category (Brothwell 1981). The second and third molars had been lost postmortem. No other remains from this individual could be aged. Therefore, an age estimate of 30 years with a possible range of 25 to 35 years was assigned to this individual based on the degree of dental attrition observed.

Individual #64

This is an adult male. The skeleton was fairly complete with the exception of the mandible, a number of vertebrae, the right scapula, seven ribs, the right patella, tibia and fibula, and some of the hand and foot bones. Although the burial had undergone some disturbance, much of the skeleton was in its original position. The foot bones, the left lower limb bones, and the left and right hand bones were in articulation. Pieces of animal skin and metal, a wooden button, and the left half of a seal mandible were found with the remains.

The pelvic bones were characterized by a narrow sciatic notch and the absence of a subpubic concavity, a median ridge and a ventral arc, features indicative of a male (Phenice 1969). The ischium-pubis index also fell within the male range (Washburn 1948). The skull possessed pronounced supraorbital ridges, blunt supraorbital margins, large mastoid processes, and a large palate, all clearly male features (Bass 1971). The designation of this individual as male was further supported by the shaft circumference of the femur (Black 1978) and by the maximum head diameter of the femur (Stewart 1979).

The maxillary molars exhibited a degree of attrition corresponding to the 25 to 35 year age range (Brothwell 1981). Analysis of the right pubic symphysis using the method developed by McKern and Stewart (1957) yielded the following results:

Component I=5
Component II=4
Component III=2
11 = 29.18 years ± 3.33

The close overlap of ages indicated by dental attrition and pubic symphysis morphology suggests that this individual was aged approximately 29.5 years with a possible range of 29 to 30 years.

Individual #65

This is an adult, probably male. The skeleton was very incomplete, lacking the skull, many of the vertebrae, the sternum, the left scapula, half of the ribs, the right humerus, the left ulna, the pelvic bones, the patellae, the tibiae, the right femur and fibula, and many of the hand and foot elements. The grave was very disturbed and none of the remains were in their original position. Associated with the burial were three buttons, one shell, one metal, and one of unknown material. No faunal remains were found.

The shaft circumference of the femur (Black 1978), the maximum head diameter of the femur (Stewart 1979), the

glenoid length of the scapula (Stewart 1979) and the maximum length of the talus (Steele 1976) all fell within male ranges, indicating that this individual is likely male.

All epiphyses of those bones present were fused, indicating that this individual was an adult; however, the absence of many of the skeletal remains, including the skull and pelvic bones, prevented the assignment of a more specific age estimate.

Individual #66

This is an adult female. The skeleton was fairly complete, lacking the skull, some vertebrae and ribs, the mesosternum, the left scapula, clavicle and humerus, the right ilium, ischium and femur, and some hand and foot bones. Most of the bones had become mixed together; however, the left foot bones, and the bones of both lower arms were in articulation. The grave contained a rifle cartridge, a fragment of black glass, pieces of metal, a wooden stopper, an unidentifiable dark grey cylindrical object, an unidentifiable skin artifact, and several seal bones, including a long bone, a vertebra and an innominate.

The pelvic bone was characterized by a number of clearly female features, including a wide sciatic notch, a

subpubic concavity and a ventral arc (Phenice 1969). Calculation of the ischium-pubis index (Washburn 1948) confirmed the female status of this individual. Several other metric observations, including the circumference of the tibia (Iscan and Miller-Shaivitz 1984), and the glenoid length of the scapula (Stewart 1979) substantiated the designation of this individual as female.

Aging of the pubic symphysis using the model developed by Gilbert and McKern (1973) produced the following results:

Component I=4
Component II=5
Component III=5
14 = 55.71 years ± 3.24

No other elements could be aged. Therefore, based on the appearance of the pubic symphysis, this individual was assigned an age estimate of 55.7 years with a possible range of 52 to 59 years.

Individual #67

This is an adult male. The skeleton was relatively complete with the exception of the skull, a few vertebrae, the left scapula, the humeri, some ribs, the fibulae, the right radius, ulna and tibia, a patella and some hand and foot bones. The grave had been disturbed and some of the bones had been scattered a distance of 10 feet from the grave. Only four cervical vertebrae remained in

articulation. A small metal ring, one button, some cloth, a seal vertebra, and a seal long bone were found with the burial.

The pelvic bones were characterized by a fairly narrow sciatic notch, a large acetabulum and the absence of a ventral arc and a subpubic concavity, indicating that this individual is a male (Phenice 1969). This conclusion was substantiated by calculation of the ischium-pubis index (Washburn 1948), and the pubic index (Miles 1986). Discriminant function analysis of the femur (Stewart 1979) and several other metric observations, including shaft circumference (Black 1978) and maximum head diameter of the femur (Stewart 1979) also supported the designation of this individual as male.

Analysis of the right pubic symphysis using the standards of McKern and Stewart (1957) yielded the following results:

Component I=4
Component II=4
Component III=2
10 = 26.05 years ± 1.87

No other remains could be aged. Therefore, based on the appearance of the pubic symphysis, the age of this individual was estimated at 26 years with a possible range of 23 to 28 years.

Individual #68

This is an adolescent of indeterminate sex. The skeletal remains consisted of almost half of the vertebrae, the right clavicle, five ribs, the left tibia, and a small number of hand and foot elements. The grave had been very disturbed and the remains had become mixed together. Some unidentifiable fibrous material and a seal bone were found with the burial.

Only the diaphyseal length of the left tibia could be measured and it yielded an age estimate of 12.5 years plus (Merchant and Ubelaker 1977). The distal epiphysis of the tibia had not yet fused, indicating an age of less than 14 years (Ubelaker 1978). Therefore an age estimate of 13 years with a possible range of 12.5 to 13.5 years was assigned to this individual.

Individual #72

This is a young adult female. The skeletal remains consisted of the mandible and left temporal bone, vertebrae, three ribs, the left upper limb bones and ilium, the right radius, patella, tibia and fibula, a maxillary incisor, and some elements of the hand and foot. The bones had become mixed together inside this cask grave. A small carved wooden doll, a notched piece of

wood, some fabric, a dog skull, an unidentifiable seal bone and a small shell were found with the remains.

Discriminant function analysis of the mandible yielded a value which fell into the female range (Giles 1964). The rounded chin form supported this assessment. Measurements of the circumference of the tibia (Iscan and Miller-Shaivitz 1984), and the maximum head diameter of the humerus (Stewart 1979) also indicated a female. The pelvic bone was damaged; however, it possessed the deep preauricular sulcus characteristic of a female.

The third mandibular molars were erupted and the first mandibular molars showed slight to moderate attrition with some dentin exposure, placing them in the 17 to 25 year age bracket but closer to the upper end of this range (Brothwell 1981). No other remains from this individual could be aged. Therefore, based on the degree of dental attrition observed, an age estimate of 21 years with a possible range of 17 to 25 years was assigned to this individual.

Individual #78

This is an adult, probably female. The skeleton was represented by vertebrae, the sacrum, one rib, the left humerus, radius and tibia, the right patella, the ulnae, one loose lower molar and a number of hand and foot bones.

This box grave had been completely torn apart and the section remaining may, in fact, belong with the remains of another grave located nearby. A few nails and one unidentifiable faunal bone were found with the bones.

Measurement of the circumference of the tibia (Iscan and Miller-Shaivitz 1984) and the maximum head diameter of the humerus (Stewart 1979) yielded values indicating a female. Discriminant function analysis of the talus (Steele 1976) was in agreement with the above observations.

All epiphyses had fused, indicating that this individual was an adult. However, the absence of the dentition and the pelvic bones prevented the assignment of a more specific age estimate.

CHAPTER V

PATHOLOGIES

The study of disease in archaeological specimens poses a number of problems for the paleopathologist. For one thing, many etiologically different diseases produce similar bone changes, making diagnosis very difficult. In addition, weathering of bones as a result of exposure to water, soil and other elements can lead to destruction of bone, thereby removing evidence of a pathology. Pathologies themselves can also weaken bone, causing more rapid deterioration of the bone and the subsequent elimination of the pathology. Another problem in the diagnosis of disease in skeletal material is that many diseases, for example diptheria, leave no trace in bone. Similarly, some types of accidental death, for example death by drowning or exposure, leave no evidence in bone. Finally, some diseases, such as tuberculosis, affect the skeleton in only a fraction of the individuals who contract the disease, while other diseases, for example syphilis, produce bone changes only in their advanced stage.

In addition to the problems outlined above, the analysis of bone pathologies at Kekerten was hindered by a number of other factors. First and foremost was the

restriction placed on the researcher by the Pangnirtung Hamlet Council that no bones or bone samples were to be removed from the site. As a result, no x-rays could be obtained and no histological or chemical analyses could be performed. All skeletal pathologies had to be carefully described and photographed in the field. Secondly, many of the burials were missing skeletal elements due to the greatly disturbed condition of the graves. Since some diseases affect only certain elements or groups of elements, the lack of a complete skeleton in several cases prevented an accurate diagnosis. Thirdly, heavy lichen and moss growth prevented visual observation of some bone surfaces for pathologies. In addition, exposure to soil, grass and water had, in many cases, resulted in the deterioration of the bones. Contact with the wood from which the burial containers were constructed also contributed to the breakdown of the bones. Skeletal elements in contact with wood are known to deteriorate more rapidly than those not in contact with wood (Ortner and Putschar 1985: 44). Below are the descriptions of the skeletal pathologies observed for each of the forty individuals analyzed over the two field seasons. The pathologies observed are summarized in Appendix G.

Individual #1

In the vertebral column of this adult female, some lipping was observed on the right inferior articular facet of the twelfth thoracic and the fourth lumbar vertebrae. The latter vertebra also had an extra facet adjacent and inferior to the left inferior articular facet. This extra facet appeared to be related to the spondylolysis in the fifth lumbar vertebra, the neural arch being completely separated from the body at the pars interarticularis. Associated with this condition in the fifth lumbar vertebra was slight compression of the vertebral body posteriorly and inferiorly. The dens of the axis vertebra exhibited slight osteoarthritic lipping.

A narrow slit approximately 15mm in length was observed running in a superior-inferior direction along the posterior edge of the radial tuberosity of the left radius. It may be related to stress imposed on the biceps muscle which attaches at this location.

The manubrium and mesosternum were fused together, an occurrence normally associated with advanced age (Krogman and Iscan 1986: 85).

In the maxilla, the buccal half of the crown of the left first premolar was broken off at the root postmortem as evidenced by the absence of wear on the fractured

edges. The first molars and the left second premolar exhibited fracture lines which appear to have occurred postmortem. All of the maxillary teeth have been lost postmortem with the exception of the fractured left first premolar, and the molars and left second premolar which remained intact and exhibited slight attrition. Alveolar recession, measured according to Patterson's (1984: 91) method, was observed, indicating periodontal disease.

Individual #4

Both clavicles of this young adult male were characterized by rhomboid fossae on the inferior surface of the sternal end, the fossa being noticeably deeper on the right clavicle than on the left one. These fossae represent impressions for the attachment of the costoclavicular ligament.

An unidentifiable left rib had a lesion measuring approximately 1 cm in diameter into the head (see Plate 6). The edges of the lesion were fairly smooth and there was no new bone growth associated with the lesion. The head appeared to be slightly expanded. Part of the articular surface of the head was still present and was characterized by slight pitting. All thoracic vertebrae were present for this individual, yet there was no sign of

infection in any of them that might be related to the lesion in the rib.

Three different diagnoses may be suggested for this lesion: monostotic fibrous dysplasia, enchondroma, or eosinophilic granuloma. Although monostotic fibrous dysplasia frequently affects the ribs, the lesion produced is always surrounded by a thin shell of periosteal bone (Ortner and Putschar 1985: 316), not the case for this individual. Enchondroma is also an unlikely cause of this lesion since it usually affects the small tubular bones of the hands and feet (Ortner and Putschar 1985: 370), the ribs being infrequently involved. The most likely cause of this rib lesion is eosinophilic granuloma. This disease occurs in young adults, is characterized by solitary bone lesions, may involve the ribs, produces a purely lytic round or oval lesion without reactive bone formation, and in ribs, can result in expansion of the cortex (Ortner and Putschar 1985: 250-251).

In the vertebral column, two unidentifiable thoracic vertebrae had a shallow depression of unknown origin into the inferior surface of the body. Both depressions, measuring approximately 1.5 cm in length, were oriented in a roughly anterior-posterior direction. The spinous process of one of these vertebrae was deviated to the right side. Another unidentifiable thoracic vertebra had

a small pit into the right superior articular facet which was probably caused postmortem since this vertebra exhibited a high degree of weathering.

A fourth lumbar vertebra exhibited a circular hole measuring approximately 1 cm in diameter into the right inferior body. The hole appears to have been made postmortem. On the same vertebra a small crack was observed through the right pars interarticularis. This crack may be the beginning of a fatigue fracture.

The fifth lumbar vertebra had osteoarthritic pitting on the left inferior articular facet associated with expansion of the facet. Localization of the pitting on only one side of the vertebra suggests that it may have been induced by trauma to this area or, alternatively, by some type of activity pattern that placed stress on this area.

In the maxilla, the first and second molars and the right second premolar were intact and exhibited slight attrition. All other teeth have been lost postmortem (although the left first premolar, the left canine and the central incisors were later recovered and exhibited no pathologies).

Individual #7

A hole into the right superior articular facet of a thoracic vertebra of this adult was probably caused postmortem. An unidentifiable lumbar vertebra had a pit of non-pathological origin located directly below the right superior articular facet. This pit may be related to an anomaly of an adjacent vertebra. Unfortunately, no other vertebrae were present.

The distal end of the shaft of the right radius showed evidence of a fracture followed by osteomyelitis. A swelling, representing callus formation, was observed on the anterior surface beginning approximately 13.5 cm from the top of the head and extending distally 2.5 cm. At this same location on the posterior surface, a large cloaca measuring 4 mm by 5 mm and several smaller cloacae were found.

Individual #11

This adult male showed extensive evidence of pathology. The left scapula was characterized by slight osteoarthritic lipping around the glenoid fossa. In addition, bony nodules resulting from injury to the triceps muscle were observed on the lateral border

directly inferior to the fossa, the location of attachment for this muscle. The left clavicle had deep pitting into the entire sternal articular surface. Deep pitting characterized the clavicular notches as well. The manubrium and mesosternum had an unusually porous texture. Ossification of the right costal cartilage was noted on the manubrium. The mesosternum had heavy lipping around the costal cartilage notches. In addition, this bone was fused to the manubrium, a feature characteristic of advanced age groups (Krogman and Iscan 1986: 85).

A hole measuring 6 mm by 4 mm was located on the frontal process of the left maxilla, directly inferior to the fronto-maxillary suture and 2 mm lateral to the nasal maxillary suture. The sharp borders of the hole and its location do not lend support to its diagnosis as an abscess. Given the high degree of postmortem damage to the facial region, it is more likely to be a tooth puncture mark.

Heavy osteoarthritic lipping was observed on the medial edge of the head of the left and right humeri. The left humerus also displayed heavy pitting on the anterior surface of the greater tubercle and on the posterior surface of the lesser tubercle as did the right humerus. Pitting on these tubercles suggests inflammation of the

supraspinatus and subscapularis muscles due to injury. The latter bone had slight lipping on the trochlea as well.

The left radius was characterized by heavy osteoarthritic pitting on the articular surface of the head. The right radius had slight osteoarthritic pitting on the medial articular surface of the head associated with slight lipping. Heavy pitting of the radial tuberosity, indicating inflammation of the biceps muscle due to injury, was observed. Finally, the pelvic bones displayed slight lipping along the superior border of the acetabulae.

In the vertebral column, the atlas was fused to the occipital condyles at the articular facets and exhibited moderate osteoarthritic pitting on the dens facet. The sixth cervical vertebra was observed to have extreme osteoarthritic pitting and lipping of the superior surface of the body and the superior articular facets. The seventh cervical vertebra, on the other hand, had extreme pitting and lipping of the inferior surface of the body and inferior articular facets. The two vertebrae were joined together by ossification of the anterior longitudinal ligament and fusion of the diarthrodial joints. The remaining four cervical vertebrae were absent.

All thoracic and lumbar vertebrae were fused together in one solid piece (see Plate 7). Ossification of the anterior longitudinal ligament, the supraspinous ligament and fusion of the diarthrodial joints had occurred, indicating ankylosing spondylitis. Although the column has sustained heavy postmortem damage, resulting in the loss of most of the transverse processes, costovertebral fusion was observed in several places. The total length of the vertebral column measured approximately 42 cm. Kyphosis approaching 45 to 50 degrees has occurred in the lower thoracic region.

In the maxilla, the right central incisor and the left canine have been lost postmortem, while the second and third molars, the left central incisor and the left lateral incisor have been lost antemortem. All other teeth remained intact and exhibited severe attrition. Enamel has chipped off the mesial, occlusal and distal surfaces of the right second premolar, and off the mesial surface of the left second premolar (Note: In this case, and in all following cases where teeth are noted to have chipped enamel, it was not determined whether the chipping had occurred postmortem or antemortem). Alveolar recession indicating periodontal disease was observed.

In the mandible, the central incisors, the lateral incisors, and the right premolars have been lost

postmortem, while all six molars have been lost antemortem. All other teeth remained intact and exhibited severe attrition. The alveolar bone has been completely resorbed on the left side of the mandible, while much resorption has occurred on the right side.

Individual #12

This adult female showed evidence of extensive pathology. In the skull, a button osteoma measuring 13 mm by 9 mm was located on the right parietal bone 10 mm lateral to the sagittal suture and directly posterior to the coronal suture. Slight to moderate osteoarthritic pitting and lipping were observed on the right occipital condyle with the lipping being most prominent along the posterior edge of the condyle. Slight osteoarthritic pitting was also observed on the anterior surface of the right mandibular fossa.

Slight pitting characterized the acromial and sternal articular surfaces of the left and right clavicles, the acromioclavicular joint of the left and right scapulae, and the glenoid fossa of the right scapula. Heavier pitting was noted in the glenoid fossa of the left scapula associated with slight lipping. Lipping was also found around the glenoid fossa of the right scapula.

The humeri exhibited slight osteoarthritic pitting on the head at the medial edge of the articular surface. This pitting was slightly heavier on the left humerus. Moderate osteoarthritic pitting and lipping were noted on the trochlea and capitulum on both sides, although the pitting was slightly heavier on the right side. The right humerus also had lipping around the radial and coronoid fossae.

The left radius had moderate osteoarthritic pitting on the anterior half of the articular surface of the head associated with moderate lipping. Moderate pitting was also observed on the articular surface of the head of the right radius; however, in this case, the pitting covered almost the entire surface of the head. It was associated with moderate lipping around the head.

Slight lipping was observed along the inferior and medial margins of the olecranon of the right ulna and along the inferior-medial margin of the olecranon of the left ulna. The contour of the right olecranon was quite different from that of the left olecranon. The presence of heavier osteoarthritis on the right side of the upper limb bones suggests that this individual was right-handed.

The right pelvic bone exhibited slight osteoarthritic pitting in the acetabulum towards the obturator foramen,

while the left patella had a protrusion of bone associated with slight pitting on the medial articular facet.

Degenerative bone changes were also quite prevalent in the ribs. The right first rib exhibited moderate osteoarthritic pitting and slight lipping on the head and articular facet of the tubercle, as well as ossification of costal cartilage. The left first rib also displayed moderate pitting on the head and articular facet of the tubercle, and ossification of costal cartilage. The right second rib had slight pitting on the articular and non-articular part of the tubercle and on the head, while the left second rib had moderate pitting on the articular facet of the tubercle. Six unidentifiable right ribs were characterized by slight osteoarthritic pitting and lipping on the head and articular facet of the tubercle. The right twelfth rib showed moderate pitting on the head. Seven unidentifiable left ribs had slight osteoarthritic pitting and lipping on the head and in two cases, on the articular facet of the tubercle as well. In addition, three of these ribs had small extensions of bone extending superiorly from the neck, representing ossification of the superior costotransverse ligament.

The vertebral column showed the greatest degree of degenerative bone changes. The atlas vertebra had moderate pitting and lipping on the dens facet and a bony

extension from the dens facet, representing ossification of the anterior longitudinal ligament. The axis vertebra had moderate pitting and lipping on the dens, as well as heavy pitting on the left inferior articular facet corresponding with heavy pitting on the left superior articular facet of the third cervical vertebra. The axis was also asymmetrical in appearance. The occurrence of pitting and expansion of the left facets of the above vertebrae suggests that the left side of these vertebrae may have sustained trauma which caused the axis to develop asymmetrically and the pitting and expansion to occur. Alternatively, these bone changes may have been induced by some type of activity pattern that placed stress on this area. The same phenomenon was observed in Individuals #59 and #40. The remaining cervical vertebrae were characterized by compression of the body associated with heavy pitting and moderate to heavy osteophytosis.

Slight osteoarthritic lipping was found on the transverse facets of the first and second thoracic vertebrae. The former vertebra also had moderate lipping and pitting on the superior body, while the latter bone had only slight pitting on the superior body. The fourth thoracic vertebra had slight lipping on the left inferior costal facet; and the fifth thoracic vertebra was characterized by slight lipping on the right inferior

costal facet. The sixth thoracic vertebra had a compression fracture (see Plate 8). The body was completely collapsed anteriorly and posteriorly, measuring only 8 mm in height. The bodies of the seventh, eighth, ninth and tenth thoracic vertebrae were slightly compressed anteriorly and posteriorly, and the latter three bodies were porous. In addition, an extension of bone was noted on the tip of the spinous process of the seventh and eighth vertebrae, representing ossification of the supraspinous ligament. Osteoarthritic pitting was found on the superior articular facets of the tenth thoracic vertebra. The eleventh vertebra had a compression fracture, resulting in kyphosis. The body was compressed anteriorly and measured 8 mm at its anterior edge. The superior surface of the body was porous. In the same vertebra, osteoarthritic pitting was observed on the superior articular facets and the right costal facet. Finally, the twelfth thoracic vertebra had a slightly compressed body anteriorly and moderate osteoarthritic pitting on the superior articular facets.

The lumbar vertebrae exhibited a number of degenerative changes. The body of the first lumbar vertebra was compressed slightly on the left side, and slight to moderate osteophyte development was observed on the superior and inferior bodies of the second, third and

fourth vertebrae. The fourth lumbar vertebra has sustained a compression fracture. The body has collapsed anteriorly, the anterior height measuring only 12 mm. The body of this vertebra was also porous. The fifth lumbar vertebra was characterized by slight compression of the body on the left side, heavy lipping of the inferior articular facets, and a deviated spinous process. Finally, the sacrum had moderate osteoarthritic pitting and lipping on the articular facets.

The presence of pitting and lipping on the transverse facets, the costal facets, and the superior and inferior articular facets of the vertebrae, and the development of osteophytes indicate possible degenerative arthritis. Unfortunately, the lack of eburnation prevents a conclusive diagnosis of this pathological condition. Alternatively, osteoporosis may have been the cause of the porosity observed in some of the vertebral bodies and the compression fractures in the sixth and eleventh thoracic and fourth lumbar vertebrae.

The hand bones of this individual showed quite a bit of osteoarthritic lipping. The first metacarpals had moderate lipping around the proximal facet, the right third metacarpal and both fourth metacarpals had moderate lipping around the distal articular surface, and the left fifth metacarpal had slight pitting of the proximal facet.

A proximal phalanx was characterized by slight lipping around the distal articular surface, a middle phalanx had a bony extension and pitting of the distal articular surface, and three distal phalanges had moderate to heavy lipping around the proximal facet associated, in one case, with heavy pitting of the proximal facet. Finally, the right trapezium exhibited moderate lipping. The foot bones of this individual did not appear to show any degenerative changes but observation of these elements was difficult in some cases due to heavy weathering of these bones. The lipping and pitting observed in the hand bones as well as in many of the other elements of this individual are indicative of degenerative arthritis.

In the maxilla, the central incisors, the left lateral incisor and the left canine were lost postmortem, while the right lateral incisor, the right canine, and all premolars and the molars were lost antemortem (see Plate 9). The alveolar bone at the location of the right second molar showed evidence of infection as indicated by the presence of a small, circular hole extending into the maxillary sinus. Finally, alveolar recession, indicating periodontal disease, was noted.

Five teeth were intact in the mandible, the left first and third molars, the right second premolar and the right second and third molars. These teeth were

characterized by severe attrition. All other teeth were lost antemortem. The alveolar bone has been completely resorbed at the location of the canines and incisors. Alveolar recession, indicating periodontal disease, was noted.

Individual #15

Some enamel was chipped off a mandibular central incisor. No other skeletal pathologies were observed in this adult.

Individual #16

A vertebral arch defect was noted in the fifth lumbar vertebra of this child. The two halves of the neural arch have failed to fuse together at the midline and the tip of the left half of the spinous process has been displaced superiorly to the right half of the process. This individual also appeared to possess an extra thoracic vertebra.

Individual #17

An area of very thin, porous bone was found on the posterior surface of the left tibia, beginning at the proximal end and extending distally approximately 30 mm. The characteristically fibrous texture of this region in normal immature bones may have predisposed the area to postmortem erosion.

An oval-shaped hole roughly 6 mm in length was found towards the proximal end of an ulna. The sharpness of the borders of this cavity suggested that it was caused postmortem. Postmortem erosion was also observed on the shaft, beginning in the midshaft region and extending distally about 35 mm.

Individual #18

In the maxilla of this child, the tooth sockets for the first permanent molars appeared to be enlarged. The significance of this feature is unknown. In the mandible, a circular hole measuring 5 mm in diameter was noted in the outer alveolus 6 mm inferior to the upper border of the alveolus at the location of the left second permanent molar. This hole is probably not an abscess since an abscess is more likely to occur once a tooth has already

erupted. A more likely explanation for this feature is that the tooth was positioned incorrectly in the jaw and has consequently caused a thinning of alveolar bone at this location, either wearing it away completely or predisposing the bone to postmortem erosion.

Individual #22

This adult shows extensive evidence of pathology. There is moderate to heavy osteoarthritic lipping around the entire margin of the head of the right radius as well as pitting on the anterior articular surface of the head and eburnation of this pitted area. Slight osteoarthritic lipping was observed around the costal cartilage facets of the mesosternum, on the heads of the right twelfth rib and another right rib, on the head of two left ribs, on the articular facet of the tubercle of another left rib, and on the proximal articular facet of the distal phalanx of the big toe. Slight osteoarthritic pitting characterized the sternal and acromial articular surfaces of the right clavicle.

The vertebral column exhibited several pathologies. Osteoarthritic lipping was observed on the dens facet of the atlas vertebra, on the right articular facet of the sacrum, on the costal facets of two thoracic vertebrae, on

the inferior articular facets of the eleventh and twelfth thoracic vertebrae, and on the superior and inferior articular facets of the third lumbar vertebra. Moderate lipping and pitting were found on the dens and inferior body of the axis vertebra. The eleventh and twelfth thoracic vertebrae showed moderate osteophytosis on the inferior and superior surface of the body respectively. As well, both of these vertebrae were osteoporotic; and the body of the eleventh thoracic vertebra was slightly compressed anteriorly and superiorly.

In addition to the osteophytosis, osteoporosis and lipping and pitting observed in the vertebral column, spondylolysis was observed in the seventh cervical vertebra (see Plate 10). The left arch was separated from the superior articular facet at the pars interarticularis. This vertebra also had moderate osteoarthritic pitting on the right half of the superior surface of the body. In another cervical vertebra, the spinous process was laterally displaced at an angle of approximately 10 degrees to the main axis of the vertebral column.

The costal end of the left first rib exhibited new bone formation, possibly the result of ossification of costal cartilage, a condition related to advanced age. This area of new bone growth extended approximately 5 cm from the costal end and has resulted in a rounded rather

than a flattened shaft end. The maximum circumference of this growth was 47 mm. No pitting was associated with the bone growth.

A left femur with a severely distorted head was found just downhill from this grave and likely belongs to this individual since the tibia found with it appears to belong to grave #22. The head was compressed superiorly and was extremely porous with some lipping around the margin (see Plate 11). Erosion of the femoral head and lipping of the margin suggests that degenerative arthritis may have been the cause of these bone changes. This disease results in destruction of the joint surface, giving the affected bone a porous apearance (Ortner and Putschar 1985: 422). Unfortunately, the absence of eburnation on the femoral head prevented a conclusive diagnosis. Alternatively, dislocation of the hip joint may have produced the distortion and porosity of the femoral head. Given the presence of degenerative bone changes in many of the other bones of this individual however,the former diagnosis appears to be more likely.

No maxilla or mandible were present for this individual; however, three loose teeth, two unidentifiable lower molars and an incisor, exhibited heavy attrition. As well, some enamel was chipped off both molars.

Individual #23

Slight osteoarthritic pitting was observed on the right inferior costal facet of a thoracic vertebra, at the acromioclavicular joint of the right scapula and on the acromial articular surface of the right clavicle of this adult female. Localization of degenerative bone changes in the right shoulder joint of this individual suggests that they may be trauma or activity related. The latter explanation seems more likely given the absence of evidence of trauma to this area. Slight osteoarthritic lipping characterized the supero-lateral margin of the olecranon of the left ulna.

While no maxillae or mandible were present, five single teeth, one lower molar, two upper molars, and two incisors, showed moderate attrition. No other dental pathologies were observed.

Individual #24

The right parietal bone of this young adult female was characterized by an area approximately 6 cm by 3 cm in size containing numerous small holes of varying sizes. The holes did not appear to extend through to the inner table. The affected area, located 20 mm lateral to the

sagittal suture and 15 mm anterior to the lambdoidal suture, appeared to be slightly denser than the surrounding cranial bone. The significance of these holes is unknown. They do not resemble bone that has sustained scalping (see Ortner and Putschar 1985: 92).

The left ulna had a punched-out hole in the radial notch that appeared to have been caused postmortem. The head of the right femur exhibited a 12 mm by 12 mm area of bone on the posterior surface adjacent to the margin that had become partially separated from the surrounding bone. A postmortem occurrence is the most likely explanation for this feature.

The fifth lumbar vertebra had two extra facets inferior to the transverse processes for articulation with the sacrum. Unfortunately the latter element was absent. The left facet measured 29 mm by 14 mm, while the right facet was damaged and therefore could not be measured. The right inferior articular facet of the same vertebra was characterized by a small hole which was probably caused postmortem given the high degree of weathering of this bone.

In the maxilla, the incisors, the right canine, the right premolars, and the left second premolar have been lost postmortem. All other teeth were intact and exhibited slight attrition. Some enamel has chipped off

the left first molar on the buccal surface. The mandible was absent, however three single mandibular teeth, one molar and two premolars, were located and exhibited no pathologies.

Individual #26

The right parietal bone of this young adult female had a small, oval-shaped hole in it 13 mm superior to the temporal bone and 23 mm posterior to the coronal suture. The sharp edges of this hole indicated that it probably occurred postmortem.

Several abnormalities were observed in the vertebral column. In the fifth lumbar vertebra, the entire left neural arch from the superior articular facet to the tip of the spinous process was absent. Stewart (1953: 944) described a fifth lumbar vertebra from Alaska also characterized by a defect "...through the pars interarticularis on one side (on the right in this specimen) and in the mid-line posteriorly", termed a Type B1 defect. In his Sadlermiut sample, Merbs found the identical defect on the right side of a sixth lumbar vertebra and referred to it as spondylolysis and spina bifida (1983: 126). Merbs noted that the spina bifida may have weakened the neural arch, thereby predisposing it to

spondylolysis (Merbs 1983: 174). The spondylolysis in this individual from Kekerten may then have been triggered by trauma, possibly a stress fracture. Associated with this defect was what appeared to be an improper formation of the right arch of the first sacral vertebra as well as a marked difference in size of the articular facets. These characteristics may also have resulted from trauma to this area. A shallow groove of unknown origin was observed in the inferior surface of the body of both the eighth and tenth thoracic vertebrae. Both grooves, measuring approximately 1.5 cm in length, were oriented in roughly an anterior-posterior direction.

The maxillae and mandible had several pathologies. The mandible was characterized by the apparent absence of the third molars; however, x-rays would be needed to determine whether these teeth were congenitally absent, or present but unerupted. An abscess was noted at the apex of the root of the left second premolar. The central and lateral incisors, the right canine and the left first premolar have been lost postmortem (although the lateral incisors and premolar were later located), while all other teeth were intact and exhibited slight attrition.

A right premolar appeared to be absent in the maxilla; however, x-rays would again be needed to verify its absence. In addition, alveolar recession indicating

periodontal disease, was observed. The left second premolar has been fractured antemortem and the fractured edges have become rounded due to wear. The presence of a pathology at the same location in the maxilla suggests that this individual may have sustained some type of trauma to this area that resulted in both a fractured tooth and an abscess. All other maxillary teeth have been lost postmortem with the exception of the first molars which remained intact and exhibited slight attrition.

Individual #28

In the mandible of this child, some enamel had chipped off the left second deciduous molar on the buccal/distal corner and off the left lateral incisor. Three other loose teeth, a maxillary canine and two maxillary incisors were also characterized by chipped enamel.

Individual #32

No skeletal pathologies were observed in this child.

Individual #33

No skeletal pathologies were observed in this child.

Individual #34

No skeletal pathologies were observed in this child.

Individual #35

No skeletal pathologies were observed in this child.

Individual #36

This child had three caries, one into the occlusal surface of the left first deciduous maxillary molar, one into the right labial surface of the left central maxillary incisor, and one into the left lingual surface of a loose left central mandibular incisor. In addition, some enamel was chipped off the mesial edge of the left central mandibular incisor and the right central maxillary incisor.

Individual #37

Two unidentifiable long bone fragments with very thin bone that has been eroded in several places may be pathological. Given the fairly high degree of weathering of a number of other skeletal elements belonging to this individual, however, it is more likely that the erosion has occurred postmortem. No other skeletal pathologies were observed in this child.

Individual #38

In the vertebral column of this child, a small subarticular pit of non-pathological origin was found on the left inferior articular facet of a thoracic vertebra, on both inferior articular facets of another thoracic vertebra, and on the right inferior articular facet of another thoracic vertebra.

The atlas vertebra exhibited a neural arch defect. The right posterior arch was separated from the lateral mass at a distance of approximately one centimetre. In addition, the right lateral mass was malformed, lacking a distinct superior articular facet.

The cranial bone appeared to be rather porous, suggesting a possible nutritional deficiency in this

individual; however, severe exfoliation of the cranial vault has made observation of porosity in this area very difficult. No porosity was observed on the palate or upper surfaces of the orbits.

In the maxilla, some enamel has chipped off the mesial surface of the right first deciduous molar.

Individual #40

The manubrium of this adult female displayed moderate osteoarthritic pitting of the clavicular notches. Moderate lipping and pitting were observed on the auricular surface and in the acetabulum of the right pelvic bone. The left tibia was characterized by moderate osteoarthritic pitting of the fibular notch. Moderate pitting was also observed on the left occipital condyle of the skull, while very slight pitting was noted on the right occipital condyle. The condyles were characterized by unusual notching into their anterior edges.

The right femur was found to be markedly heavier than the left femur and was characterized by a thickening of the upper shaft, particularly noticeable in the neck region. The circumference of the right femur, taken directly below the lesser trochanter measured 98 mm. In contrast, the circumference of the left femur, taken at

exactly the same location measured 79 mm. The head of the right femur was positioned at a slightly lower angle than that of the left femur. The outer appearance of both bones was similar. The thickening of the shaft and the heavy weight of this bone, caused by the obliteration of the medullary cavity are characteristic of nongummatous periostitis; however, the femur lacked the hypervascularity also characteristic of this condition. A more likely explanation for the observed abnormality is a well-healed bone fracture which would account for the altered neck angle and the increased bone density.

In the vertebral column, the axis displayed moderate osteoarthritic pitting and expansion of the right inferior articular facet. Corresponding to this feature was moderate pitting and expansion of the right superior articular facet of the third cervical vertebra. Localization of pitting on only one side of these vertebrae suggests that these bone changes may have been the result of trauma to this area. Alternatively, some type of activity pattern may have placed stress on this region, causing degenerative changes to occur. The same phenomenon was observed in Individuals #12 and #59 but on the opposite side.

The fourth cervical vertebra showed slight pitting on the lateral sides of the inferior body. Moderate pitting,

lipping and expansion were observed on the inferior articular facets of the sixth cervical vertebra and on the superior articular facets of the seventh cervical vertebra. The latter bone also displayed slight lipping and pitting of the inferior articular facets.

Slight osteoarthritic lipping was observed on the left inferior articular facet of the twelfth thoracic vertebra and on both inferior articular facets of two unidentifiable lumbar vertebrae. Moderate to heavy lipping was found on all articular facets of the fifth lumbar vertebra but was particularly prominent on the right inferior articular facet. As well, a bony growth similar to that observed in Individual #64 extended from the right inferior articular facet to the right transverse process, creating a foramen. The significance of this growth is unknown.

In the maxilla, only four teeth remained intact, the left canine, the left premolars and the left second molar. All other teeth have been lost antemortem (see Plate 12). Severe attrition characterized those teeth present. Infection has resulted in extensive periapical bone destruction in the region of the right premolars and molars, causing exposure of the maxillary sinus.

In the mandible, only five teeth remained intact, the left lateral incisor, the left canine and first premolar,

and the right canine and second premolar. These teeth exhibited severe attrition. All other teeth have been lost antemortem. The right body of the mandible was somewhat more robust than the left side. This robustness may be related to the pathology observed in the right maxilla.

Individual #41

No skeletal pathologies were observed in this child.

Individual #43

In the vertebral column of this adult male, a small pit of unknown origin was observed in the middle of the inferior surface of the body of a thoracic vertebra. The pit was shallow and measured several millimetres in diameter. In addition, the spinous process of this vertebra was deviated to the left at an angle of approximately 3 degrees. A small pit of nonpathological origin was located on the nonarticular part of the tubercle of a left rib. The articular facet of the tubercle of a right rib had some osteoarthritic pitting.

A fairly large depression measuring 15 mm by 7 mm with roughened edges was found on the inferior surface of

the right clavicle at the sternal end. This rhomboid pit, the location of attachment of the rhomboid or costo-clavicular ligament, has been accentuated by postmortem erosion. Some postmortem damage has also occurred at the sternal articular surface of this clavicle.

The right humerus was characterized by a depression measuring 27 mm by 8 mm into its anterior surface approximately 70 mm distal to the top of the head. The left humerus exhibited an almost identical depression at exactly the same location as that on the right humerus. These depressions represent impressions for attachment of the pectoralis major and teres major muscles.

The maxilla and mandible of this individual showed little evidence of oral pathology. In the mandible, all teeth have been lost postmortem except for the first molars, the left premolars and the left canine which remained intact and exhibited slight attrition. The left third molar, the right second molar, and the incisors were later located and exhibited no pathologies. Crowding and anterior displacement of the left central incisor has occurred. In addition, a small pit measuring 5mm by 3mm was located on the medial side of the left mandibular condyle. This pit was attributed to postmortem damage rather that to osteoarthritis since no evidence of

degenerative change was observed in the left mandibular fossa.

In the maxilla, the incisors and second and third molars have been lost postmortem (although the left second molar, the right third molar and the left and right central incisors were later retrieved). All other teeth remained intact and exhibited slight attrition. Some enamel has chipped off the right second premolar on the lingual side, the right first molar on the buccal and lingual sides, and the left first molar on the lingual side.

Individual #45

Slight lipping was observed on the right inferior articular facet of a thoracic vertebra of this adult female. The glenoid cavity of the right scapula appeared to have some pitting in the centre; however, lichen growth and weathering in this region prevented positive identification of the pitting.

The left femur exhibited a very small, localized area of bone growth measuring 6 mm by 4 mm on its anterior surface in the midshaft region, approximately 20 cm proximal to the tip of the lateral condyle. This growth may represent focal periostitis or an osteoid osteoma.

The lack of density of the bone growth suggests that the former diagnosis is more likely. The periostitis may have been caused by trauma to this area although this possibility seems unlikely since the femur is protected by a thick layer of muscle and fat. Alternatively, the growth may have been caused by some type of localized infectious focus.

In the mandible, all teeth were present except for the canines, incisors and left first premolar which had been lost postmortem. Attrition was slight on those teeth present. Some enamel was chipped off the left second premolar on the mesial and lingual surfaces.

The maxillary incisors, canines and right premolars were lost postmortem (although the right lateral incisor was later located and found to have enamel chipped off its mesial and distal edges). The entire crown of the right first molar has broken off just above the cemento-enamel junction and only the lingual and distal roots remained in place. The crown of the right third molar has also broken off above the cemento-enamel junction and only two small root stubs remained in the tooth socket. Both breaks were clean and showed no evidence of wear, indicating that the teeth were broken postmortem. The left premolars, the right second molar and the left molars were intact and exhibited slight attrition. On the left first molar, some

enamel has chipped off the buccal-distal surface. Some postmortem damage has occurred to the alveolar bone at the location of the incisors, canines and right first premolar.

Individual #47

No skeletal pathologies were observed in this child.

Individual #50

This adult male had slight pitting on the sternal articular surface of the left clavicle, some of which appears to have occurred postmortem while other pitting may be related to fusion of the sternal epiphysis. Osteoarthritic pitting was observed on the right superior articular facet of a thoracic vertebra. This pitting was associated with expansion of the facet.

The middle and distal phalanges of the fifth finger (side unknown) have fused together. The fusion is smooth and the bones are almost perfectly aligned. A number of pathological conditions, including rheumatoid arthritis, infection and trauma can result in fusion of joints. The absence of osteoporosis in the affected bones suggests that rheumatoid arthritis was not a factor here.

Similarly, the absence of cloacae, sequestra and hypervascular periosteal bone makes infection an unlikely cause. Localized trauma to the hand appears to be the most likely explanation for this fusion; however, the absence of most of the other hand bones from this individual prevents a conclusive diagnosis.

Three teeth, a right canine, a left first molar and a left second molar, were present in the maxilla, the remaining teeth having been lost postmortem with the exception of the right third molar which appears to have been lost antemortem as indicated by reactive alveolar bone in the tooth socket. Alveolar recession has occurred, indicating periodontal disease.

A mandible with the left second premolar and the first molars intact was found close to this grave. The left and right central incisors, the left lateral incisor and possibly the right second molar were lost antemortem, while all other teeth were lost postmortem. Enamel has chipped off the buccal surface of the left second premolar, the buccal surface of the left first molar and the buccal surface and lingual/posterior corner of the right first molar. The entire mandible showed alveolar recession. Although this bone was found quite close to grave #50, it did not appear to belong to this individual. This is suggested by the fact that laterally, the

mandibular condyles did not fit well into the mandibular fossae of the skull of individual #50. As well, the mandibular molars exhibited a heavier degree of attrition than the maxillary molars, suggesting that this mandible may belong to an older individual.

Individual #51

A vertebral arch defect was noted in the first sacral vertebra of this child. The two halves of the neural arch have failed to fuse together in the midline and the tip of the left half of the spinous process has been displaced superiorly to the right half of the process.

Individual #57

Porosity of the roof of the orbits, or cribra orbitalia, indicated an iron-deficiency anemia in this child.

Individual #59

The manubrium of this adult female was characterized by moderate ossification of costal cartilage on both sides, while the mesosternum displayed slight lipping

around the left and right costal cartilage notches. On the left humerus, a small nodule of bone surrounded by osteoarthritic pitting was observed protruding inferiorly from the inferior articular surface between the trochlea and capitulum. Slight lipping was observed along the medial edge of the head of the left radius, while moderate pitting was noted on the acromial articular surface of the right clavicle. Localization of degenerative bone changes in the left elbow joint suggests that this individual may have sustained trauma to this area. Alternatively, these bone changes may have been induced by some type of activity pattern that placed stress on this joint.

Both first ribs had slight pitting on the head and some ossification of costal cartilage, the ossification being slightly heavier on the left rib. An unidentifiable left rib showed moderate osteoarthritic lipping extending inferiorly from the articular surface of the tubercle.

In the vertebral column, the axis exhibited moderate to heavy osteoarthritic pitting and expansion of the left inferior articular facet. This bone also appears to have developed asymmetrically, there being greater bone growth around the left transverse foramen than around the right foramen. The third cervical vertebra was characterized by moderate to heavy pitting and expansion of the left superior articular facet and slight lipping on the right

inferior articular facet. The occurrence of pitting and expansion on the left articular facets of the above vertebrae, and the asymmetry of the axis suggests that these vertebrae may have sustained trauma to the left side which caused the axis to develop asymmetrically and the pitting and expansion of the facets to occur. Alternatively, these features may have a functional significance. The same phenomenon was noted in the axis and third cervical vertebrae of Individuals #12 and #40.

The sixth thoracic vertebra had a small osteophyte protruding from the inferior body at the midline; and the seventh thoracic vertebra had a corresponding osteophyte protruding from the superior body at the midline. Slight osteoarthritic lipping was found on the right inferior articular facet of the fifth lumbar vertebra. Finally, an unidentifiable lumbar vertebra showed slight lipping on the inferior articular facets, a deviated spinous process, and a pit of non-pathological origin directly inferior to the left superior articular facet.

In the maxilla, the incisors, second molars and third molars were lost postmortem. All other teeth were intact and exhibited slight attrition. The right first molar has been fractured; however, the fractured area was clean and sharp, indicating that the fracture occurred postmortem. Three root stubs remained in the tooth socket. Enamel has

chipped off the distal/lingual corner of the left first molar, the lingual surface of the left second premolar, and the distal and buccal surfaces of the right second premolar.

Individual #60

The left scapula of this adult male was characterized by pitting in the centre of the glenoid fossa which appeared to be related to fusion of the epiphysis. Pitting which may be osteoarthritic but is more likely postmortem damage was noted on the medial surface of the head of the right radius. An unidentifiable left rib had slight osteoarthritic lipping on the articular facet of the tubercle.

Three lesions were located in the right auricular surface of the sacrum (see Plate 13). The first lesion was located in the first sacral vertebra, the second lesion, measuring 15 mm in diameter, was located between the first and second sacral vertebrae, and the third lesion, measuring 10 mm in diameter, was located between the second and third sacral vertebrae. In addition, two drainage canals measuring 5 mm in diameter, were noted anterior to the third lesion. The localized destruction and cavitation of cancellous bone and the absence of

periosteal reactive bone are indicative of tuberculosis (Ortner and Putschar 1985: 144). Tuberculosis of the pelvis most often affects the sacroiliac joint (Ortner and Putschar 1985: 149), the joint affected here.

In the maxilla, the canines, premolars, and the left first molar were intact and exhibited moderate attrition. All other teeth have been lost postmortem (although the right first molar was later recovered and found to have a large piece of the crown broken off the mesial/lingual corner). Some enamel has chipped off the mesial/buccal corner of the left first molar, while the right first premolar has been fractured postmortem and the distal half of the crown was absent. A hole in the outer alveolus at the location of the right first molar appeared to have been made postmortem. The mandible was absent; however, one unidentifiable mandibular premolar had some enamel chipped off one edge.

Individual #61

The skull of this adult male showed extensive evidence of pathology. Five fairly shallow healed depression fractures were found on the frontal, occipital and parietal bones. A circular depression fracture measuring 15 mm by 13 mm was located on the occipital bone

approximately one centimetre inferior to lambda. Associated with this fracture was a triangular area of periosteal reactive bone directly inferior to, and encompassing, the depression. In addition, a 6-8 cm wide area of periosteal reactive bone was observed running along the entire sagittal suture, possibly a result of infection caused by trauma to the occipital bone.

Another smaller depression fracture measuring 5 mm by 5 mm was found on the right frontal bone 2 cm inferior to the coronal suture and 3 cm lateral to the sagittal suture. No periosteal reactive bone was associated with this fracture.

The right parietal bone had a depression fracture measuring 15 mm by 20 mm located approximately 4 cm superior to pterion and just posterior to the coronal suture, while the left parietal bone exhibited two almost circular depression fractures (see Plate 14). The first one measured 25 mm by 22 mm and was located roughly 3 to 4 cm above pterion and 5 mm posterior to the coronal suture, while the second fracture, the deepest of the five, measured 25 mm by 15 mm and occurred in the posterior half of the parietal bone almost mid-way between the sagittal suture and asterion. Between the two depressions on the left parietal bone was an area of periosteal reactive bone approximately 55 mm by 60 mm in size.

All of the cranial fracture sites were fairly smooth and complete healing was indicated by the presence of new bone growth. All fractures appeared to have occurred at approximately the same time. Although detailed observation of the inner table was difficult without proper lighting, the bone did not appear to have been affected by the trauma.

The nasal bones have been laterally displaced, indicating a broken nose. As well, the floor of the right orbit was missing, indicating a possible blow-out fracture resulting from trauma to the facial region.

Numerous pathologies were found in other areas of the skeleton. Both femora had moderate to heavy osteoarthritic lipping along the margin of the head. This lipping was most marked on the posterior side of the head in both cases, but was generally more pronounced on the right femur than on the left femur. In addition, the left femur had some osteoarthritic lipping around the fovea capitis and pitting in and directly superior to the fovea capitis.

The distal end of the right ulna had a deep hole measuring 10 mm by 20 mm into the antero-lateral surface of the shaft and part of the head. Postmortem erosion appears to be the likeliest explanation for this cavity.

Osteoarthritic pitting was found on the right inferior articular facets of a thoracic and a lumbar vertebra, and on the right superior articular facet of another thoracic vertebra. The occurrence of these degenerative changes on one side only suggests that they may be trauma-related. Ossification of the ligamentum flavum in one of the above thoracic vertebrae further supports the suggestion of trauma-induced bone changes. A lumbar vertebra showed evidence of incomplete fusion of the neural arches. Although fusion has occurred, a slight gap remained at the midline.

Osteoarthritic pitting was observed on the head and tubercle of the left first rib and on the acromial articular surface of the right clavicle. The manubriosternal joint of the manubrium was characterized by both pitting and lipping as well as the presence of bone nodules, suggesting possible trauma to this area. Ossification of the first costal cartilage had occurred on the right side of the manubrium. The costal cartilage notches and manubriosternal joint of the mesosternum had some lipping around them.

The ribs of this individual exhibited several pathologies. One rib fragment had a slight bony extension or swelling of the superior and inferior margins of the shaft 25 mm from the costal end indicating a possible

healed fracture. Another left rib showed the same phenomenon 5 cm from the costal end, also indicative of a possible healed fracture. A third left rib was characterized by an oval depression measuring 20 mm by 7 mm into the anterior surface of the shaft approximately 5 cm from the costal end. The bottom of this depression had a roughened appearance due to the formation of new bone. The segment of the shaft containing the depression was not evenly aligned with the remainder of the shaft. The malalignment of this rib, as well as the presence of a depression exhibiting new bone growth are indicative of a healed fracture.

Two teeth remained intact in the maxilla, the left second premolar and the left first molar. All other teeth have been lost postmortem (although the left canine, the right central incisor, and right first and second molars were later located and exhibited no pathologies). The right first premolar appeared to have been rotated and displaced lingually and may have been lost antemortem. In addition, new bone growth was observed on the palatine process in this area. This bone growth is most likely related to the facial trauma sustained by this individual.

In the mandible, the left and right first molars were present. All other teeth have been lost postmortem with the exception of the right second and third molars which

have been lost antemortem as indicated by the presence of reactive alveolar bone in the tooth sockets. The left first and second premolars were later located and exhibited no pathologies. Alveolar recession, indicating periodontal disease, has occurred.

Individual #62

The right inferior articular facet of a thoracic vertebra belonging to this adult female was characterized by pronounced osteoarthritic pitting and lipping. The absence of pitting and lipping on the left inferior articular facet suggests that the degenerative changes to the right facet may have been the result of trauma or, alternatively, some type of activity pattern that placed stress on this location.

All maxillary teeth have been lost postmortem except for the right canine and the right and left first molars which remained intact. The enamel on the first molars has been badly chipped. There were a number of holes into the alveolar bone at the location of the right premolars and central incisor, and at the left first premolar. While lichen growth in this area prevented a conclusive diagnosis, postmortem damage appears to have been the cause of these holes. The entire crown of an

unidentifiable loose tooth, possibly an incisor or a canine, had been destroyed by caries.

Individual #64

A fracture was noted 5 cm anterior to the head of the right twelfth rib of this adult male (see Plate 15). A line has been retained around the entire shaft at the fracture site and the shaft was slightly thickened at this location. The presence of a line suggests that following the occurrence of the fracture, the fractured ends were inadequately immobilized and inadequate mineralization of the callus occurred, resulting in a pseudarthrosis or nonunion. At a later stage, fusion commenced but is not yet complete as evidenced by the line.

In the vertebral column, the sixth cervical vertebra had moderate osteoarthritic pitting on the superior surface of the body associated with moderate lipping of the right lateral edge of the superior body with pitting into the lipping. An unidentifiable lower thoracic vertebra was characterized by an expanded left inferior articular facet of indistinct shape. The fourth lumbar vertebra had moderate osteoarthritic lipping on the inferior articular facets, while the fifth lumbar vertebra exhibited unusual bony growths extending from the left and

right inferior articular facets to the left and right transverse processes respectively, creating a foramen on both sides (see Plate 16). The significance of these growths is unknown.

The first ribs exhibited slight to moderate ossification of costal cartilage. Slight osteoarthritic lipping was observed around the distal articular surface of the right first metacarpal.

In the maxilla, the left central incisor and the right third molar have been lost postmortem (although they were later recovered and exhibited no pathologies). All other teeth remained intact. The right central incisor has been fractured, the labial and lateral one quarter of the tooth having broken off. The mesial/lingual corner of the right first molar has also broken off. In addition, some enamel has chipped off the mesial surface of the left first molar, the mesial/lingual corner of the left second molar, the distal/lingal and distal/buccal corners of the left third molar, the lingual surface of the right first premolar, and the lingual surface of the right second premolar. A very interesting wear pattern, characterized by a triangular notch into the inferior edge of the lateral incisors and canines at the point where the two teeth meet, may be related to a particular activity that required the use of these teeth.

Individual #65

The left humerus of this adult was characterized by two grooves beginning approximately 6 cm inferior to the top of the head. The first groove, located on the medial surface, measured 3 cm in length, while the second groove, located on the anterior surface, measured 2.7 cm in length. The grooves ran parallel to one another and were separated by 1 cm. They represent impressions for attachment of the pectoralis major and teres major muscles.

In the vertebral column, an unidentifiable thoracic vertebra and a first or second lumbar vertebra were found to have a shallow depression of unknown origin in the inferior surface and superior surface of the body respectively. In the first case, the depression measured slightly less than 1 cm in length and several millimetres in width, and was oriented in an anterior-posterior direction. The depression in the lumbar vertebra was circular, measuring several millimetres in diameter. Another thoracic vertebra had what appeared to be an expanded left inferior articular facet, while another thoracic vertebra, possibly an eleventh vertebra, had slight osteophytosis on the inferior body. A second or

third lumbar vertebra displayed slight osteoarthritic lipping on the inferior articular facets.

Individual #66

Degenerative bone change in the form of a small, localized area of bone growth was observed on the medial articular facet of the right patella of this adult female. Some osteoarthritic pitting was found on the sternal articular surface of the right clavicle, while lipping occurred on the inferior border of the sternal end. Lipping was also observed around the first costal cartilage notches of the manubrium representing ossification of costal cartilage.

The manubrium had a deep, almost circular hole measuring approximately one centimetre in diameter into the anterior surface directly inferior to the left clavicular notch and a few millimetres medial to the notch for the first costal cartilage. The right second rib appeared to exhibit a slight swelling in the midshaft region associated with a circular hole into the superolateral surface of the shaft.

In the vertebral column, moderate lipping was observed on the inferior articular facets of a lumbar vertebra, slight lipping extended superiorly from the dens

facet of the atlas vertebra, and a small pit of non-pathological origin was located in each of the superior costal facets of a thoracic vertebra. In addition, several deep, circular holes similar to those found in the manubrium and right second rib were present in two vertebrae. A thoracic vertebra had two holes, one into the superior surface of the body on the right side and the other into the inferior surface, also on the right side. A lumbar vertebra with lipping on the superior and inferior articular facets also had a deep, almost circular hole into the inferior surface of the body on the left side. No new bone growth was associated with any of these holes.

The presence of circular lesions in cancellous bone, specifically in the manubrium, the second rib, and the bodies of a thoracic and a lumbar vertebra, and the absence of periosteal reactive bone suggests that tuberculosis may have been the cause of these lesions. Tuberculosis most frequently affects the spine and involves almost exclusively the vertebral body (Ortner and Putschar 1985: 145). However, it may also affect one or more ribs as well as the sternum, in particular the manubrium (Ortner and Putschar 1985: 162), as observed in this individual.

Individual #67

Osteoarthritic lipping was found on the articular facet of the tubercle of three right ribs, on the head of one of these right ribs as well as a left rib, and on the articular facet of the tubercle of the right first rib of this adult male.

In the vertebral column, shallow grooves of unknown origin were observed running in a medial-lateral direction in the superior surface of the bodies of the twelfth thoracic vertebra and another thoracic vertebra, and in the inferior surface of the body of another thoracic vertebra. The grooves measured 3 cm, 2 cm, and 2 cm respectively. The fourth lumbar vertebra was characterized by an extra facet directly adjacent and inferior to each inferior articular facet. These extra facets appeared to be related to the bilateral spondylolysis of the fifth lumbar vertebra, separation of the neural arch having occurred at the pars interarticularis.

Eleven single teeth, 2 premolars, 4 canines, and 5 incisors, all exhibiting fairly severe attrition, were found in the grave. The enamel was slightly chipped on the crowns of two premolars.

Individual #68

No skeletal pathologies were observed in this adolescent.

Individual #72

The radial tuberosity of the right radius of this young adult female appeared to have been eaten away. An area 2 cm in length on the lateral surface of the shaft, approximately 36 mm distal to the tuberosity, has also been eroded. The sharp edges of both areas, however, indicated that the erosion likely occurred postmortem.

There appears to have been improper fusion of the neural arches of the sacral vertebrae. The median sacral crest was absent and in its place, a line was present, extending from the top of the first sacral vertebra to the sacral hiatus which rose to the level of the second pelvic sacral foramen.

All mandibular teeth have been lost postmortem except for the left canine, premolars and first molar, and the right canine, first and third molars which remained intact. Crowding and anterior displacement of the first premolars has occurred. The right mandibular teeth were characterized by heavier wear than the left teeth.

Individual #78

A small depression, measuring 1 cm in length and several millimetres in depth, was found in the inferior surface of the body of a thoracic vertebra of this adult. The granular condition of the bone made it difficult to determine whether this depression occurred antemortem or postmortem.

A small, localized area of bone growth associated with some osteoarthritic pitting was observed towards the centre of the medial articular facet of the right patella.

CHAPTER VI

DISCUSSION

The significance of the pathologies described in the previous chapter will now be discussed under the following headings: trauma, infectious diseases, osteoarthritis, pathologies of the vertebral column, dental pathologies and miscellaneous pathologies. Since the primary goal of this thesis is to assess the health status of the Kekerten Inuit during the whaling period, this discussion will focus on the significance of the pathologies in terms of what they reveal about the health and lifestyle of the Kekerten Inuit. At the same time, the effects of Euroamerican contact on the health of these individuals will also be investigated. In order to address this issue, comparisons will be drawn between the burial populations at Niutang and Tasioya, dated to A.D. 1750-A.D. 1850 (Salter 1984: 42) and the Kekerten material. It should be noted that due to time restrictions, Salter examined in detail only the left half of the skeleton for the presence of pathologies (Salter 1984: 227). Thus any comparisons made between her burial populations and the Kekerten population must be viewed with this bias in mind. Finally, information on the health status of the Kekerten Inuit as revealed in the skeletal pathologies will be augmented by a brief discussion of demography.

Trauma

Evidence of trauma was observed in 5/40 (12.5%) individuals, all adults. Individual #61, a male, showed the most extensive evidence of trauma with 5 healed cranial depression fractures, a broken nose, a possible blow-out fracture in the right orbit, and 3 healed rib fractures. Individual #7 had sustained a fracture of the distal right radius which had been followed by osteomyelitis. The beginning of a fatigue fracture through the right pars interarticularis of the fourth lumbar vertebra was observed in Individual #4, a young male. Individual #64, a male, had sustained a fracture in the mid-shaft of the right 12th rib which had healed before death, while Individual #40, a female, showed evidence of a possible fracture, now healed, through the neck of the right femur.

Two other individuals exhibited bone changes that may have been trauma induced. Fusion of the middle and distal phalanges of the fifth finger of Individual #50 may have been caused by localized trauma to the hand, while the compression and porosity observed in the left femoral head of Individual #22 may have been the result of a dislocation, although Schaefer (1959: 391) notes that congenital hip dislocation has not been observed among Inuit populations.

Salter (1984: 239) recorded evidence of trauma in 3/48 (6.25%) individuals from Niutang and 1/49 (2.0%) individuals from Tasioya. The remains of one individual from Niutang, a middle-aged male, had been cut and burned at the time of burial. A female from the same site had sustained a blow to the right parietal bone, while a third individual from Niutang showed evidence of trauma to the left maxilla. One individual from Tasioya had also sustained a blow to the right parietal bone (Salter 1984: 239).

The trauma observed in the skeletal remains at Kekerten appears to be both intentional and accidental. The extensive trauma observed in Individual #61 clearly indicates that this adult was the victim of intentional violence. In contrast, the fractures observed in Individuals #7, #64 and possibly #40 were likely the results of accidental falls. Injury from falls would not be unexpected in a rugged environment such as the Arctic. The fatigue fracture in the fourth lumbar vertebra of Individual #4 was probably produced by stress applied to this vertebra over a fairly long period of time (Ortner and Putschar 1985: 55), perhaps due to some type of activity in which this individual was frequently engaged.

With one exception, all of the fractures observed in the Kekerten remains were healed, indicating that they

were not the cause of death. The exception was the fracture observed in the distal right radius of Individual #7 which had been followed by osteomyelitis. Without the aid of antibiotics during this time period, infectious organisms may have spread from the fracture site and caused an infection of the blood (septicemia), resulting in the death of this individual (Ortner and Putschar 1985: 64).

Infectious Diseases

Two adults exhibited bone changes that may have been produced by an infectious disease, possibly tuberculosis. Individual #60, a male, had lesions in the right auricular surface of the sacrum which were almost certainly caused by tuberculosis. The bone changes observed in the manubrium, the right second rib and two vertebrae of Individual #66, a female, may also have been produced by this disease although the evidence in this case is less conclusive.

Salter (1984: 266) recorded 6 possible cases of tuberculosis, 3 from Niutang and 3 from Tasioya. At Niutang, a male aged 31 years, a female aged 34 years, and a male aged 58 years exhibited lesions indicative of this disease, while at Tasioya, two 41 year-old males, and a 29

year-old female showed evidence of possible tuberculosis (Salter 1984). Four of these individuals showed involvement of the vertebral column.

Tuberculosis is caused by the *Mycobacterium tuberculosis*. This infectious organism usually enters the body through the respiratory tract and becomes focused in the lungs; however, the infection may also enter through the intestinal tract (Ortner and Putschar 1985: 141). From their focus in the lungs, the infectious organisms may then be disseminated through the blood to other areas of the body including the bone tissue. Of the total number of individuals infected with the disease, only a very small percentage show skeletal involvement (Kastert and Uehlinger 1964: 444-445, cited in Ortner and Putschar 1985: 142).

Tuberculosis primarily affects adolescents and young adults (Buikstra 1976: 358). If an individual's resistance is poor, the disease can result in acute osteomyelitis and an early death (Morse 1961: 489). If, on the other hand, an individual's resistance is good, the tuberculosis can be chronic with the individual living for some time past adolescence (Ortner and Putschar 1985: 170).

Conclusive evidence for the existence of tuberculosis in the New World in prehistoric times has been presented

by a number of researchers (see Ritchie 1952, Morse 1961, El-Najjar 1979 and Buikstra 1981). However, Schaefer (1959: 250) notes that the disease became a problem for the Inuit only after contact with white whalers, traders and trappers. In Oswalt's (1979: 289) opinion, tuberculosis "...probably has had a more profound effect on Eskimos than any other disease introduced historically." Buikstra (1976: 363) notes references to the existence of this disease among early post-contact Caribou Eskimo.

At Kekerten, close contact between the Inuit and the Scottish and American whalemen almost certainly resulted in the spread of this disease from the whalemen to the Inuit. While conclusive evidence for tuberculosis was observed in only one individual at Kekerten, given the fact that only a small percentage of individuals who contract the disease show skeletal involvement, it is possible that a greater number of individuals actually had the disease but it did not progress to the stage where the bone tissue was affected. Therefore it is difficult to draw any comparisons between the incidence of tuberculosis in the Kekerten burial population and the incidence of this disease in the burial populations at Niutang and Tasioya. Consequently, no statements can be made

regarding whether or not the frequency of tuberculosis has increased over time.

No evidence for syphilis was found in any of the skeletal remains at Kekerten. This observation was somewhat surprising, given the fact that logbooks from a number of whalers record the presence of venereal disease among crew members (Ross 1975: 120); and opportunities for the transmission of syphilis to the Inuit during the whaling period would likely have been quite frequent. The following reference, taken from a journal of a whaling voyage from Dundee to Davis Strait in 1894, attests to just one incidence of sexual contact between Inuit and whalemen at Blacklead Island, a whaling station south of Kekerten:

> We were at once boarded by a cargo of Female Yaks called Koonies and for the whole time every man had his squaw. It was positively sickening. If people call that whaling the sooner it is stopped the better (Redgrave 1894, cited in Savours 1960: 136).

Oswalt (1979: 288) states that syphilis was almost certainly introduced into Inuit populations by whalemen, while Boas (1964: 18) asserts that of all the diseases introduced to the Inuit by the whalemen, "...syphilis has made the greatest ravages among the natives". Low (1906: 272) also believes that sexually transmitted disease resulted in many deaths among the Inuit.

The lack of skeletal evidence for syphilis at Kekerten does not necessarily mean that the disease was not present in the population. Since syphilis affects bone tissue only in its advanced or tertiary stage (Ortner and Putschar 1985: 182), it may well be that individuals who contracted this disease died before the disease reached an advanced stage. This would suggest a very low resistance to this condition. No evidence for syphilis was found in the burial populations at Niutang and Tasioya (Salter 1984).

Osteoarthritis

Osteoathritis, also known as degenerative joint disease, is a "...disorder of diarthrodial joints characterized by deterioration and abrasion of articular cartilage and formation of new bone at the joint surfaces" (Steinbock 1976: 278). The most common type of arthritis, this disease produces significant bone changes beginning around the fourth decade in modern populations (Heine 1926, cited in Ortner and Putschar 1985: 419). The joints most often affected are the weight-bearing joints, specifically the hip and knee. Other joints which are frequently affected include the shoulder, elbow, and first metatarsophalangeal joint. A number of factors are

believed to play a role in the development of this disease. These include age, sex, hormones, metabolic factors, heredity and stress (Jurmain 1977). While aging is probably one of the most important factors in the development of osteoarthritis, in Jurmain's (1977: 363) opinion, "...no factor is the single primary focus in the etiology of degenerative joint disease."

The disease begins with the degeneration of the articular cartilage. As the cartilage becomes worn away, new bone forms around the margins of the cartilage. This new bone formation is referred to as "lipping". The subchondral bone becomes weakened due to the formation of cystic defects. Once the cartilage has been completely worn away, the underlying exposed bone is subjected to attrition resulting in the polishing, or eburnation, of the bone (Ortner and Putschar 1985: 419-420).

Table 2 summarizes the incidence of osteoarthritis in the cranium and appendicular skeleton. All arthritic changes were described as pitting, lipping, eburnation or a combination of two or more of these categories; and the degree of the degenerative bone changes was noted as being either slight, moderate, or heavy. However, for the purposes of frequency calculations, osteoarthritis has been recorded in Table 2 as simply being present or absent. The frequencies have been recorded for males,

Table 2

Incidence of Osteoarthritis

Bone	Side	Male n	Male Incidence	Male Incidence %	Female n	Female Incidence	Female Incidence %	All n	All Incidence	All Incidence %
Cranium										
mandibular fossa	Left	7			8			16		
	present		0	0.0		0	0.0		0	0.0
	absent		7	100.0		8	100.0		16	100.0
	Right	7			8			16		
	present		0	0.0		1	12.5		1	6.2
	absent		7	100.0		7	87.5		15	93.8
Clavicle										
medial end	Left	6			4			13		
	present		1	16.7		1	25.0		2	15.4
	absent		5	83.3		3	75.0		11	84.6
	Right	3			8			14		
	present		0	0.0		2	25.0		3	21.4
	absent		3	100.0		6	75.0		11	78.6
lateral end	Left	6			3			11		
	present		0	0.0		1	33.3		1	9.1
	absent		6	100.0		2	66.7		10	90.9
	Right	5			7			15		
	present		1	20.0		3	42.9		5	33.3
	absent		4	80.0		4	57.1		10	66.7
Scapula										
glenoid fossa	Left	6			6			13		
	present		1	16.7		1	16.7		2	15.4
	absent		5	83.3		5	83.3		11	84.6
	Right	4			6			12		
	present		0	0.0		1	16.7		1	8.3
	absent		4	100.0		5	83.3		11	91.7
acrom-ion	Left	6			6			13		
	present		0	0.0		1	16.7		1	7.7
	absent		6	100.0		5	83.3		12	92.3
	Right	4			6			12		
	present		0	0.0		2	33.3		2	16.7
	absent		4	100.0		4	66.7		10	83.3
Humerus										
head	Left	3			4			9		
	present		1	33.3		1	25.0		2	22.2
	absent		2	66.7		3	75.0		7	77.8
	Right	4			5			9		
	present		1	25.0		1	20.0		2	22.2
	absent		3	75.0		4	80.0		7	77.8
trochlea	Left	5			6			13		
	present		0	0.0		2	33.3		2	15.4
	absent		5	100.0		4	66.7		11	84.6
	Right	4			6			10		
	present		1	25.0		1	16.7		2	20.0
	absent		3	75.0		5	83.3		8	80.0

Table 2 - continued

Bone	Side	Male n	Male Incidence %		Female n	Female Incidence %		All n	All Incidence %	
capitu-	Left	5			6			13		
lum	present		0	0.0		2	33.3		2	15.4
	absent		5	100.0		4	66.7		11	84.6
	Right	4			6			10		
	present		0	0.0		1	16.7		1	10.0
	absent		4	100.0		5	83.3		9	90.0
Radius										
ulnar	Left	7			9			19		
notch	present		0	0.0		0	0.0		0	0.0
	absent		7	100.0		9	100.0		19	100.0
	Right	6			8			17		
	present		0	0.0		0	0.0		0	0.0
	absent		6	100.0		8	100.0		17	100.0
head	Left	7			10			20		
	present		1	14.3		2	20.0		3	15.0
	absent		6	85.7		8	80.0		17	85.0
	Right	6			8			18		
	present		1	16.7		1	12.5		3	16.7
	absent		5	83.3		7	87.5		15	83.3
distal	Left	7			9			19		
end	present		0	0.0		0	0.0		0	0.0
	absent		7	100.0		9	100.0		19	100.0
	Right	6			8			17		
	present		0	0.0		0	0.0		0	0.0
	absent		6	100.0		8	100.0		17	100.0
Ulna										
radial	Left	7			9			19		
notch	present		0	0.0		0	0.0		0	0.0
	absent		7	100.0		9	100.0		19	100.0
	Right	6			8			17		
	present		0	0.0		0	0.0		0	0.0
	absent		6	100.0		8	100.0		17	100.0
olecranon										
process	Left	6			9			18		
	present		0	0.0		2	22.2		2	11.1
	absent		6	100.0		7	77.8		16	88.9
	Right	6			8			17		
	present		0	0.0		1	12.5		1	5.9
	absent		6	100.0		7	87.5		16	94.
coronoid										
process	Left	6			9			18		
	present		0	0.0		0	0.0		0	0.0
	absent		6	100.0		9	100.0		18	100.0

Table 2 - continued

Bone	Side	Male n	Male Incidence	%	Female n	Female Incidence	%	All n	All Incidence	%
	Right	6			8			17		
	present		0	0.0		0	0.0		0	0.0
	absent		6	100.0		8	100.0		17	100.0
distal	Left	7			9			19		
end	present		0	0.0		0	0.0		0	0.0
	absent		7	100.0		9	100.0		19	100.0
	Right	6			8			17		
	present		0	0.0		0	0.0		0	0.0
	absent		6	100.0		8	100.0		17	100.0
Hip										
acetabu-	Left	5			6			11		
lum	present		1	20.0		0	0.0		1	9.1
	absent		4	80.0		6	100.0		10	90.9
	Right	6			5			11		
	present		1	16.7		2	40.0		3	27.3
	absent		5	83.3		3	60.0		8	72.7
auricular										
surface	Left	5			7			12		
	present		0	0.0		0	0.0		0	0.0
	absent		5	100.0		7	100.0		12	100.0
	Right	6			5			11		
	present		0	0.0		1	20.0		1	9.1
	absent		6	100.0		4	80.0		10	90.9
Femur										
fovea	Left	8			7			16		
capitis	present		0	0.0		0	0.0		0	0.0
	absent		8	100.0		7	100.0		16	100.0
	Right	5			5			10		
	present		0	0.0		0	0.0		0	0.0
	absent		5	100.0		5	100.0		10	100.0
head	Left	8			7			16		
	present		1	12.5		0	0.0		1	6.2
	absent		7	87.5		7	100.0		15	93.8
	Right	5			5			10		
	present		1	20.0		0	0.0		1	10.0
	absent		4	80.0		5	100.0		9	90.0
medial										
condyle	Left	7			5			14		
	present		0	0.0		0	0.0		0	0.0
	absent		7	100.0		5	100.0		14	100.0
	Right	4			4			8		
	present		0	0.0		0	0.0		0	0.0
	absent		4	100.0		1	100.0		8	100.0
lateral										
condyle	Left	6			6			14		
	present		0	0.0		0	0.0		0	0.0
	absent		6	100.0		6	100.0		14	100.0

Table 2 - continued

Bone	Side	Male n	Male Incidence %	Female n	Female Incidence %	All n	All Incidence %
	Right	4		5		9	
	present	0	0.0	0	0.0	0	0.0
	absent	4	100.0	5	100.0	9	100.0
Patella							
medial	Left	3		8		13	
facet	present	0	0.0	1	12.5	1	7.7
	absent	3	100.0	7	87.5	12	92.3
	Right	2		9		12	
	present	0	0.0	1	11.1	2	16.7
	absent	2	100.0	8	88.9	10	83.3
lateral	Left	3		8		13	
facet	present	0	0.0	0	0.0	0	0.0
	absent	3	100.0	8	100.0	13	100.0
	Right	2		9		12	
	present	0	0.0	0	0.0	0	0.0
	absent	2	100.0	9	100.0	12	100.0
Tibia							
medial							
condyle	Left	6		6		15	
	present	0	0.0	0	0.0	0	0.0
	absent	6	100.0	6	100.0	15	100.0
	Right	4		6		11	
	present	0	0.0	0	0.0	0	0.0
	absent	4	100.0	6	100.0	11	100.0
lateral							
condyle	Left	6		6		15	
	present	0	0.0	0	0.0	0	0.0
	absent	6	100.0	6	100.0	15	100.0
	Right	4		6		11	
	present	0	0.0	0	0.0	0	0.0
	absent	4	100.0	6	100.0	11	100.0
distal	Left	6		5		13	
end	present	0	0.0	0	0.0	0	0.0
	absent	6	100.0	5	100.0	13	100.0
	Right	4		6		11	
	present	0	0.0	0	0.0	0	0.0
	absent	4	100.0	6	100.0	11	100.0
Fibula							
proximal							
facet	Left	4		4		8	
	present	0	0.0	0	0.0	0	0.0
	absent	4	100.0	4	100.0	8	100.0
	Right	2		7		10	
	present	0	0.0	0	0.0	0	0.0
	absent	2	100.0	7	100.0	10	100.0

Table 2 - continued

Bone	Side	Male n	Male Incidence %		Female n	Female Incidence %		All n	All Incidence %	
distal facet	Left	5			6			12		
	present		0	0.0		0	0.0		0	0.0
	absent		5	100.0		6	100.0		12	100.0
	Right	3			8			12		
	present		0	0.0		0	0.0		0	0.0
	absent		3	100.0		8	100.0		12	100.0
Talus proximal facet	Left	4			6			13		
	present		0	0.0		0	0.0		0	0.0
	absent		4	100.0		6	100.0		13	100.0
	Right	4			5			13		
	present		0	0.0		0	0.0		0	0.0
	absent		4	100.0		5	100.0		13	100.0

females, and both sexes combined, and for the left and right sides, with n representing the number of individuals for whom an observation could be made.

In the cranium, arthritis of the mandibular fossa was observed in 1/16 (6.2%) individuals, in this case on the right side only.

Arthritis of the medial articular surface of the clavicle was found in 4 individuals, in 2/13 (15.4%) individuals on the left side and in 3/14 (21.4%) individuals on the right side (one of these individuals showed involvement on both sides). Arthritis of the lateral articular surface was noted in 5 individuals, in 1/11 (9.1%) individuals on the left side and in 5/15 (33.3%) individuals on the right side (one of these individuals exhibited bilateral involvement).

The glenoid fossa of the scapula exhibited arthritic changes in 2 individuals, in 2/13 (15.4%) skeletons on the left side and in 1/12 (8.3%) skeletons on the right side (one of these individuals showed involvement on both sides). Arthritis of the acromion was also observed in 2 individuals, in 1/13 (7.7%) individuals on the left side and in 2/12 (16.7%) individuals on the right side (one of these skeletons was affected on both sides).

Higher incidences of arthritis characterized the humerus. 22.2% (2/9) of the individuals displayed

arthritic bone changes on both the left and right humeral heads. Arthritis of the trochlea was observed in 3 individuals, in 2/13 (15.4%) individuals on the left side and in 2/10 (20.0%) individuals on the right side (one of these individuals showed involvement on both sides). Arthritis of the capitulum was recorded in 2 individuals, in 2/13 (15.4%) skeletons on the left side and in 1/10 (10.0%) skeletons on the right side (one of these skeletons was affected on both sides).

The ulnar notch and distal articular facet of the radius exhibited no arthritis, while on the radial head, arthritic changes were noted in 4 individuals, in 3/20 (15.0%) individuals on the left side and in 3/18 (16.7%) individuals on the right side (2 of these skeletons showed bilateral involvement).

Arthritis of the ulna was also uncommon. Only the olecranon process exhibited arthritic changes, with 2 individuals being involved, 2/18 (11.1%) on the left side and 1/17 (5.9%) on the right side (one of these individuals was affected on both sides).

In the pelvic bones, 3 individuals had arthritis in the acetabulum, 1/11 (9.1%) individuals on the left side and 3/11 (27.3%) individuals on the right side (one of these skeletons showed bilateral involvement). 9.1% (1/11) of individuals exhibited arthritic changes on the

right auricular surface. No arthritis was observed on the left auricular surface.

The incidence of arthritis was low for the femora. The fovea capites, medial condyles and lateral condyles exhibited no degenerative bone changes, while only one individual had arthritis of the femoral head, the incidence being 6.2% on the left side and 10.0% on the right side.

Arthritis was observed on the medial facet of the patella in 3 individuals, in 1/13 (7.7%) skeletons on the left side and in 2/12 (16.7%) skeletons on the right side. The lateral facets were free of degenerative bone changes.

No arthritis was observed in any of the tibiae, fibulae or tali.

Females showed greater arthritic involvement than males overall. This observation is in contrast with Merbs' (1983) findings for the Sadlermiut skeletal remains. The incidence of arthritis was higher in females for the right mandibular fossa, the medial and lateral articular surfaces of the left and right clavicles, the glenoid fossa of the right scapula, the acromion of the left and right scapulae, the trochlea of the left humerus, the capitulum of the left and right humerus, the head of the left radius, the olecranon process of the left and right ulnae, the acetabulum and auricular surface of the

right pelvic bone, and the medial facet of the left and right patellae. Greater involvement of the mandibular fossa in females was also observed by Merbs (1983) who attributed this sex difference to the use of the teeth by females for softening skins and boots.

Males showed higher frequencies of arthritis in the head of the left and right humeri, the trochlea of the right humerus, the head of the right radius, the acetabulum of the left pelvic bone, and the head of the left and right femora.

Comparing the frequencies of arthritis on the left and right sides of the skeleton for both sexes combined, a higher incidence was observed on the right side for the mandibular fossa, the medial and lateral clavicle, the acromion of the scapula, the trochlea of the humerus, the head of the radius, the acetabulum and auricular surface of the pelvic bone, the head of the femur and the medial facet of the patella. The glenoid fossa of the scapula, the capitulum of the humerus and the olecranon process of the ulna exhibited higher frequencies of arthritis on the left side.

In contrast to the Kekerten burial population, osteoarthritis occurred more frequently in males than in females at both Niutang and Tasioya (Salter 1984). In addition, the lower limb bones were more frequently

affected at the latter two sites than at Kekerten. It should be noted, however, that Salter recorded the incidence of osteoarthritis in only the left half of the skeleton and not the right half. Thus any comparisons between the three sites must be made with this bias in mind.

Salter (1984) observed athritis at Niutang in the mandibular fossa of the skull, the lateral clavicle, the glenoid fossa and acromion of the scapula, the head and trochlea of the humerus, the ulnar notch, head and distal end of the radius, the radial notch of the ulna, the acetabulum and auricular surface of the pelvic bone, the fovea capitis and medial and lateral condyles of the femur, the lateral facet of the patella, and the medial and lateral condyles of the tibia (both sexes combined).

The Niutang females exhibited a higher incidence of arthritis in the mandibular fossa of the skull, the head of the humerus, the head of the radius, the radial notch of the ulna, the acetabulum of the pelvic bone, the lateral facet of the patella, and the medial and lateral condyles of the tibia. In contrast, males exhibited greater degenerative bone changes in the lateral clavicle, the glenoid fossa and acromion of the scapula, the trochlea of the humerus, the ulnar notch and distal end of the radius, the auricular surface of the pelvic bone, and

the fovea capitis, medial and lateral condyles of the femur (Salter 1984).

At Tasioya, degenerative bone changes were observed in the medial clavicle, the head of the humerus, the distal end of the radius, the acetabulum of the pelvic bone, the fovea capitis, head, medial and lateral condyles of the femur, the lateral facet of the patella and the lateral condyle of the tibia (both sexes combined). The females showed a higher incidence of arthritis in the humeral head, while the males exhibited greater degenerative changes in the medial clavicle, the distal end of the radius, the acetabulum of the pelvic bone, the fovea capitis, head, medial and lateral condyles of the femur, the lateral facet of the patella and the lateral condyle of the tibia (Salter 1984).

Pathologies of the Vertebral Column

Spondylolysis refers to a condition characterized by the separation of the neural arch from a vertebra. The separation can occur through one of three areas, the pars interarticularis, the lamina or the pedicle, and may be unilateral or bilateral (Merbs 1983: 120). The defect most commonly affects the lumbar vertebrae with the highest frequency being found in the fifth lumbar vertebra

(Merbs 1983: 40); however, the cervical and thoracic vertebrae may also be affected. Spondylolysis occurs more frequently in males than in females (Merbs and Wilson 1962: 159). The frequency of the condition has also been observed to increase with age (Stewart 1953) and to have a genetic basis (Lester and Shapiro 1968: 46-47). The trait has never been observed in newborns (Merbs and Wilson 1962: 159).

While the cause of spondylolysis is still poorly understood, Stewart (1953: 949) has suggested that among Inuit groups, it may be related to a particular posture in which the individual sits or stands with his legs fully extended and his back and hip joints hyperflexed. Alternatively, the condition may be trauma induced, either by an episode of acute trauma or by sustained stress (Merbs 1983: 38). Merbs (1983: 153) has suggested that spondylolysis can be produced by carrying, dragging or lifting a heavy object.

Given the fact that spondylolysis is known to occur in high frequencies among Inuit populations (Stewart 1931), it is not surprising that a number of cases were recorded in the Kekerten burial population. Individuals #1, an adult female, and #67, an adult male, had bilateral spondylolysis of the fifth lumbar vertebra. Unilateral defects were found in the seventh cervical vertebra of

Individual #22, an adult, in the atlas vertebra of Individual #38, a child, and in the fifth lumbar vertebra of Individual #26, a young adult female. In the latter case, the defect through the left pars interarticularis was accompanied by a defect through the posterior midline. This condition was associated with a defect in the arch of the first sacral vertebra. Saunders (1978: 240) notes that a cleft in the arch of the fifth lumbar vertebra is usually accompanied by a cleft in the arch of the first sacral vertebra. Salter (1984: 263) recorded two cases of bilateral spondylolysis in the fifth lumbar vertebra, one from Niutang and one from Tasioya.

In addition to spondylolysis, several other vertebral arch defects were found in the skeletal remains at Kekerten. A defect was found at the posterior midline of the fifth lumbar vertebra of Individual #16, a child, and at the posterior midline of the first sacral vertebra of Individual #51, also a child. A partial cleft characterized the posterior midline of an unidentifiable lumbar vertebra of Individual #61, an adult male, and the posterior midline of the sacrum of Individual #72, a young adult female. Such defects are commonly referred to as spina bifida, a failure of the 2 halves of the posterior vertebral arch to fuse (Merbs and Wilson 1962: 156). However, Hintze (1922) has suggested that the term spina

bifida not be used since, as Schmorl and Junghanns (1971: 84) note, this condition is very common and is usually not associated with any disturbance of the nervous system. No posterior midline arch defects were recorded by Salter in the Niutang and Tasioya burial populations (1984: 263).

Individual #16, a child, appeared to possess an extra thoracic vertebra. This condition is not unknown among Inuit populations. Stewart (1932: 127) reported 13 Alaskan Inuit who had 5 lumbar vertebrae and 13 thoracic vertebrae and noted that in comparison with other races, the Inuit have the highest incidence of long vertebral columns (1932: 135). Merbs (1974: 13) also noted the presence of extra thoracic vertebrae in 11/70 (15.7%) Sadlermiut. No cases of extra vertebrae were noted in Salter's burial populations.

Osteoporosis is a condition characterized by diminished bone mass which results when the rate of bone resorption surpasses that of bone formation (Ortner and Putschar 1985: 289). The most frequent form of this condition is senile osteoporosis which usually begins in the fifth decade and occurs more frequently and with greater severity in females due, in part, to the sharper decrease in estrogens at menopause in females than the decrease in testosterone in males (Ortner and Putschar 1985: 289). Other factors have also been suggested as

playing a role in the onset of osteoporosis. These include prolonged lactation and inadequate calcium intake (Dewey, Armelagos and Bartley 1969: 26), and physical activity (Ericksen 1976). Osteoporosis may occur as a disease in itself or as a result of other pathological conditions, including trauma and infection.

In the Kekerten sample, two individuals showed bone changes which may be indicative of osteoporosis. The eighth, ninth, tenth and eleventh thoracic vertebrae and the fourth lumbar vertebra of Individual #12, a female aged 45+ years, were very porous, indicating possible osteoporosis, in this case associated with degenerative arthritis. The eleventh and twelfth thoracic vertebrae of Individual #22, an adult aged 35-45 years were also quite porous. When viewed as a separate entity and not as part of another disease process, osteoporosis was recorded by Salter as having a low incidence at Niutang and Tasioya, one individual from the first site and two individuals from the second site exhibiting this condition (Salter 1984: 262).

Osteophytosis is a condition characterized by the formation of osteophytes, or bony spurs, around the superior and inferior margins of the vertebral bodies. It is usually related to degeneration of the intervertebral disc, specifically the narrowing of this disc (Merbs and

Wilson 1962: 164). The condition can affect any part of the spine and few or many vertebrae may be involved (Ortner and Putschar 1985: 421).

The Kekerten burial population displayed a very low incidence of osteophytosis. Only four individuals had osteophytes and in three of these cases, the osteophytes were limited to only one or two vertebrae. Individual #22, a middle-aged adult, showed moderate osteophyte development on the eleventh and twelfth thoracic vertebrae. Individual #59, an adult female, had a small osteophyte on the sixth and seventh thoracic verebrae, while Individual #65, a probable male, showed osteophytosis on a lower thoracic verebra. Osteophytosis was most extensive in Individual #12, an older female, with seven vertebrae, the fourth, fifth, sixth and seventh cervical and the second, third and fourth lumbar vertebrae, being involved.

In terms of their general distribution in the vertebral column, osteophytes were noted in the middle to lower cervical, middle thoracic and lower thoracic, and middle to lower lumbar regions. This pattern resembles that observed by Merbs (1983) in the Sadlermiut material. In this case, osteophyte development was concentrated in the lower cervical, middle thoracic and middle to lower

lumbar vertebrae (Merbs 1983: 104), a pattern related to the natural curvature of the spine (Merbs 1983: 169).

The sample size was too small to detect differences in the frequency and degree of osteophytosis between the sexes, differences in the involvement of the superior vs. the inferior margin of the affected vertebral bodies, and side differences.

Ortner and Putschar (1985: 420-421) note that osteophytosis is "...common in skeletal material past middle age." This observation did not appear to be the case at Kekerten however. A number of older individuals did not show any osteophyte development at all. This observation supports the findings of Stewart (1958) and McKern and Stewart (1957) that osteophytosis is not a very reliable age indicator.

Salter (1984: 261) recorded a low incidence of osteophytosis at Tasioya with only 4 cases, all female, being observed. In contrast, ten individuals at Niutang, 2 females and eight males, had osteophytosis.

Osteoarthritis of the spine was observed in 15 adults, 8 females, 5 males and 2 individuals of unknown sex. The degenerative bone changes were concentrated primarily in the upper cervical, lower cervical, lower thoracic and lower lumbar regions. The apophyseal joints

were most frequently involved, with the right articular facets being slightly more involved than the left facets.

In contrast, Salter (1984: 263) observed a very low incidence of osteoarthritis of the vertebral column at Niutang and Tasioya. Only four individuals from the first site and one individual from the second site were affected. All five cases involved the cervical vertebrae.

Compression fracturing refers to "...a condition in which a vertebral body, usually the anterior portion of it, becomes diminished in height" (Merbs 1983: 32). Such fractures may be caused by trauma or other pathological conditions. Ortner and Putschar (1985: 289) note that compression fractures resulting in flattened or wedge-shaped vertebrae are a common occurrence in individuals with osteoporosis. At Kekerten, compression fractures were noted in the sixth and eleventh thoracic vertebrae and the fourth lumbar vertebra of Individual #12, an adult female. In this case, they appear to have resulted from osteoporosis. Salter (1984) noted compressed vertebrae in 4 individuals from Niutang, a 50 year-old male, a 42 year-old female, a 34 year-old female and a 19 year-old male. At Tasioya, one individual, a 29 year-old female, had a compressed vertebra. In two of the above cases, the fractures appeared to be associated with tuberculosis.

Ankylosing spondylitis is a progressive inflammatory disease which primarily affects the vertebral column, specifically the diarthrodial joints, the sacroiliac joints and the costovertebal joints. Other joints, including the shoulder, hip and knee joints, may be involved in about half of the cases (Ortner and Putschar 1985: 411). The disease begins in the second or third decade of life and affects males in 9 out of 10 cases. It usually begins in the lumbar region of the spine and in the sacroiliac joints and spreads upward to the cervical vertebrae. Inflammation of the joints leads to bony ankylosis which results in the rigid "bamboo" spine. The etiology of this disease is unknown. One case of ankylosing spondylitis involving a male over 50 years of age was observed at Kekerten. The disease has also been noted in other Inuit, including an adult male from Alaska (Ortner and Putschar 1985: 413). Salter did not record any cases at Niutang or Tasioya.

Dental Pathologies

A total of 469 permanent teeth/alveoli were examined at Kekerten. 256 of these were maxillary teeth, 155 were mandibular teeth, 53 were unidentifiable loose teeth, and 5 were first molars observed in the maxillae and mandibles

of children. The status of the adult maxillary and mandibular dentition is summarized in Table 3. The unidentifiable loose teeth and the 5 permanent molars identified in the dentition of children are not recorded in this table.

In the maxillary dentition, 52.3% of the teeth had been lost postmortem, 34.4 % were intact, and 12.5 % had been lost antemortem. In the mandibular dentition, 45.8% of the teeth had been lost postmortem, 31.0% were intact, and 21.9% had been lost antemortem.

Since antemortem tooth loss is often the result of dental pathology, a low incidence of antemortem loss may therefore be interpreted as reflecting a generally good state of dental health (Cybulski 1973: 87). In the Kekerten sample, 32/256 (12.5%) maxillary teeth had been lost antemortem (both sexes combined). In contrast, only 16/302 (5.3%) maxillary teeth in the Niutang population and 12/322 (3.7%) maxillary teeth in the Tasioya population had been lost antemortem. A similar pattern was observed for the mandibular dentition. At Kekerten, 34/155 (21.9%) mandibular teeth had been lost antemortem, while the frequencies at Niutang and Tasioya were only 12.7% (39/306 teeth) and 8.3% (35/424 teeth) respectively.

Viewing the males and females separately, the same pattern of increased antemortem loss over time was

Table 3

Maxillary Tooth Status - Adult Males*

Status	Left Tooth								Right Tooth								Total	%
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8		
LP**	5	4	0	2	4	6	5	9	9	5	2	2	2	5	5	7	72	56.7
I	1	3	7	5	4	3	1	0	1	2	5	4	5	4	2	0	47	37.0
AL	1	1	0	0	0	0	1	1	0	0	0	1	0	0	1	2	8	6.3
AR																		
F																		
Tot.	7	8	7	7	8	9	7	10	10	7	7	7	7	9	8	9	127	100.0

Maxillary Tooth Status - Adult Females

Status	Left Tooth								Right Tooth								Total	%
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8		
LP	3	3	0	2	2	5	7	7	7	7	4	4	5	0	3	3	62	48.0
I	3	4	6	4	5	3	0	0	0	0	2	1	1	6	3	2	41	31.8
AL	2	1	2	1	1	0	1	1	1	2	2	2	2	2	2	2	24	18.6
AR												1					1	0.8
F				1													1	0.8
Tot.	8	8	8	8	8	8	8	8	8	9	8	8	8	8	8	8	129	100.0

Maxillary Tooth Status - All Adults

Status	Left Tooth								Right Tooth								Total	%
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8		
LP	8	7	0	4	6	11	12	16	16	12	6	6	7	5	8	10	134	52.3
I	4	7	13	9	9	6	1	0	1	2	7	5	6	10	5	3	88	34.4
AL	3	2	2	1	1	0	2	2	1	2	2	3	2	2	3	4	32	12.5
AR												1					1	0.4
F				1													1	0.4
Tot.	15	16	15	15	16	17	15	18	18	16	15	15	15	17	16	17	256	100.0

Table 3 - continued

Mandibular Tooth Status - Adult Males

Status	Left Tooth 8	7	6	5	4	3	2	1	Right Tooth 1	2	3	4	5	6	7	8	Total	%
LP	3	2	0	2	2	1	4	4	4	4	2	3	3	0	2	1	37	66.1
I	0	0	2	2	2	2	0	0	0	0	1	0	0	2	0	0	11	19.6
AL	1	1	1	0	0	0	0	0	0	0	0	0	0	1	2	2	8	14.3
AR																		
F																		
Tot.	4	3	3	4	4	3	4	4	4	4	3	3	3	3	4	3	56	100.0

Mandibular Tooth Status - Adult Females

Status	Left Tooth 8	7	6	5	4	3	2	1	Right Tooth 1	2	3	4	5	6	7	8	Total	%
LP	1	1	0	0	3	1	4	3	3	4	2	1	1	0	1	0	25	30.1
I	2	2	4	3	2	3	1	0	0	0	2	2	4	3	3	3	34	41.0
AL	1	2	1	2	1	1	1	2	2	2	1	2	0	2	1	1	22	26.5
AR	1															1	2	2.4
F																		
Tot.	5	5	5	5	6	5	6	5	5	6	5	5	5	5	5	5	83	100.0

Mandibular Tooth Status - All Adults

Status	Left Tooth 8	7	6	5	4	3	2	1	Right Tooth 1	2	3	4	5	6	7	8	Total	%
LP	5	4	0	2	6	3	8	7	7	9	5	5	5	0	3	2	71	45.8
I	2	2	7	6	4	5	1	0	0	0	3	2	4	6	3	3	48	31.0
AL	2	3	2	2	1	1	2	3	3	2	1	2	0	3	4	3	34	21.9
AR	1															1	2	1.3
F																		
Tot.	10	9	9	10	11	9	11	10	10	11	9	9	9	9	10	9	155	100.0

*Tables after Salter (1984)
**LP=Lost Postmortem
I=Intact
AL=Antemortem Loss
AR=Absent-Reason?
F=Fractured Antemortem
Tot.=Total

observed in both groups. The incidences of antemortem tooth loss among females at Niutang, Tasioya and Kekerten were 8.8% (7/80 teeth), 5.9% (11/188 teeth), and 18.6% (24/129 teeth) respectively for the maxillary teeth, and 21.8% (17/78 teeth), 9.7% (21/216 teeth), and 26.5% (22/83 teeth) respectively for the mandibular teeth. The incidences of antemortem tooth loss among males at Niutang, Tasioya and Kekerten were 4.4% (9/206 teeth), 1.0% (1/102 teeth), and 6.3% (8/127 teeth) respectively for the maxillary teeth, and 10.5% (22/210 teeth), 2.8% (4/144 teeth), and 14.3% (8/56 teeth) respectively for the mandibular teeth.

Performance of a chi-square test (Siegel 1956: 107) on the above values for both sexes combined revealed that the rate of antemortem tooth loss in the maxillary dentition of the Kekerten burial population was significantly different that that reported by Salter (1984) for the Niutang burial population ($x^2=8.248$, $df=1$, $p<0.05$) and for the Tasioya population ($x^2=14.386$, $df=1$, $p<0.05$). Similarly, the rate of antemortem tooth loss in the mandibular dentition of the Kekerten Inuit was significantly different than that of the Niutang sample ($x^2=5.849$, $df=1$, $p<0.05$) and the Tasioya sample ($x^2=18.956$, $df=1$, $p<0.05$).

In order to determine whether or not the observed increase in antemortem tooth loss over time was simply a reflection of a larger number of older individuals in the Kekerten sample, the mean age at death was calculated for each of the three burial populations. For Kekerten, this was done by adding up the age at death of each individual (see Table 1) and dividing this sum by the total number of individuals for which age could be determined (63). This yielded a mean age at death of 16.7 years. The mean age at death for the Niutang population was determined by adding up the "best ages" (see Salter 1984: 129-130) and dividing the sum by the total number of individuals for which age was estimated (40). This produced a mean age at death of 34.7 years. Similarly, at Tasioya, an average was taken of the "best ages" and a mean age at death of 36 years was obtained.

The substantially lower mean age at death of the Kekerten burial population than that of the Niutang and Tasioya populations indicates that the higher incidence of antemortem tooth loss observed at Kekerten is not the result of a greater number of older individuals in the sample but reflects, instead, a decline in dental health over time.

At all three sites, the incidence of antemortem tooth loss was greater in females than in males for both the

maxillary and mandibular dentition. Since Inuit males and females are known to use their teeth differently (Costa 1980: 505), with the females using a greater number of teeth than the males (Merbs 1983: 157), the higher frequencies of antemortem tooth loss in the females is not unexpected. Merbs (1983) observed a higher frequency of antemortem tooth loss in Sadlermiut females than in males and attributed this difference to the female practice of chewing skins and boots to soften them.

The fairly high number of teeth lost postmortem, 52.3% of the maxillary teeth and 45.8% of the mandibular teeth, is not surprising given the high degree of disturbance of many of the burials at Kekerten. Salter (1984:187) notes that postmortem loss of teeth at her sites was probably due to rodent activity. Animals were likely also responsible, to a large extent, for the postmortem loss of teeth at Kekerten. The teeth most frequently lost postmortem were the anterior teeth, an observation which is in agreement with Costa's (1980: 505) statement that incisors are most frequently lost postmortem.

Dental caries is defined as "...an infectious and transmissible disease [involving] progressive destruction of tooth structure initiated by microbial activity on the tooth surface" (Pindborg 1970: 256). Caries may occur at

three different locations on the tooth: 1) the occlusal surface, 2) the approximal surfaces (ie. the mesiodistal and buccolingual surfaces), and 3) the root. Pindborg (1970: 256) distinguishes two types of dental caries: acute and chronic. The first type is characterized by a white chalky spot, while the second type is yellow to brown in colour. The disease primarily affects children and young adults, with the incidence generally dropping after the age of 25 (Patterson 1984: 68).

Determining the incidence of caries in an archaeological population may be difficult for several reasons: 1) teeth are often damaged or lost postmortem; 2) antemortem tooth loss may or may not be the result of dental caries; and 3) heavy dental attrition observed in most archaeological specimens may wear away the occlusal surfaces before caries can develop (Ortner and Putschar 1985: 439).

At Kekerten, a total of 221 permanent teeth were examined for dental caries, 88 intact maxillary teeth, 48 intact mandibular teeth, 53 unidentifiable loose teeth, 27 identifiable loose teeth that have been recorded in Table 3 as being lost postmortem, and 5 first molars from the maxillae and mandibles of children . Of these 221 teeth, only one tooth, possibly an incisor or a canine belonging to Individual #62, an adult female, was carious. In this

particular case, caries had destroyed the entire crown, leaving only the root. Thus the frequency of dental caries in the permanent dentition is 0.45%.

Of the 77 deciduous teeth examined, only three teeth, all belonging to Individual #36, displayed caries, yielding a frequency of 3.9%. The affected teeth in this case were the left first deciduous maxillary molar, the left central maxillary incisor, and the left central mandibular incisor. Combining the permanent and deciduous dentition (298 teeth) produced an overall caries frequency of 1.3%. While this frequency is very low, the high number of teeth that have been lost postmortem in the adults, some of which may have been carious, makes one cautious in accepting this frequency as accurate. In addition, some of the 66 teeth lost antemortem may have been carious. A low frequency of dental caries was also observed in the burial populations at Niutang and Tasioya. The incidence of maxillary caries at Niutang and Tasioya was 2.8% and 0.6% respectively, while the incidence of mandibular caries was 4.2% at Niutang and 0.6% at Tasioya (Salter 1984: 239).

Salter (1984: 258) attributed the low incidence of dental caries in her burial populations to an absence of sugar in the diet of these individuals during the pre-contact period and to the consumption of sea mammals which

may contain high levels of fluoride (Mayhall 1970: 118). A number of researchers have pointed out the trend towards an increase in the incidence of dental caries among Inuit populations following the introduction of European foods. Collins (1932: 452) noted that pre-contact Inuit groups possessed teeth that showed a remarkably low incidence of caries. Following contact with whites and the subsequent introduction of new foods into the diet, however, the rate of caries has increased. He notes that in Alaska this increase has been observed not only in situations where the native diet has been almost completely replaced by a European diet but also in cases where the new European foods have simply supplemented the traditional diet (1932: 461).

Historical records from Kekerten document the introduction of European foods to the Inuit during the whaling period. Those Inuit employed by the station received weekly rations of such items as bread and molasses (Wakeham 1898: 75). Ross (1984: 20) notes that these items brought caries to the Inuit, yet Hantzsch (1977: 129) remarked that tooth decay was rare among the Inuit with whom he was associated during his stay on Baffin Island from 1909-1911. Similarly, McEuen's 1937 study of the dentition of 82 Pangnirtung Inuit revealed only 6 individuals with caries (McEuen 1938). If the low

incidence of dental caries observed at Kekerten is, in fact, a fairly accurate reflection of the actual incidence of caries in this population, it suggests that the impact of European foods on the dental health of the Inuit may not have been substantial until much later in time. On the other hand, the significant increase in antemortem tooth loss over time, as discussed above, suggests that the frequency of dental caries calculated for the Kekerten material may be incorrect, with the actual frequency being much higher. This, of course, assumes that the antemortem tooth loss was due to caries and not to attrition or periodontal disease, an assumption that, unfortunately, cannot be proven.

Dental attrition refers to the wearing down of the tooth surface. Pindborg (1970: 294) makes a distinction between two types of attrition: physiologic, which results from natural mastication, and pathologic, which results from an abnormal position or use of the teeth. Attrition of the occlusal surface may result in exposure of the underlying dentin. If tooth wear is severe and threatens the exposure of the pulp cavity, a layer of secondary dentin may be produced. Extreme attrition may, in turn, destroy this secondary dentin, thereby exposing the pulp cavity which can then become infected (Ortner and Putschar 1985: 454). Attrition may also occur on the

interproximal surfaces of the teeth resulting from slight movement between adjacent teeth caused by chewing (Ortner and Putschar 1985: 454). A number of factors can contribute to tooth wear. These include diet, the chewing of plants and other substances for non-dietary reasons, and the use of the teeth as tools (Molnar 1972). Dental attrition has been used to estimate the age at death of archaeological skeletons; however, this method is not considered particularly reliable due to the fact that attrition rates vary widely between populations and even among individuals of the same population (Ubelaker 1978: 64). Pindborg (1970: 296) notes that tooth wear was much greater in the past than it is in most modern-day groups.

Inuit teeth are commonly observed to exhibit advanced wear (Turner and Cadien 1969: 303). This high degree of dental attrition has been attributed to the chewing of raw meat, whaleskin and fish (Schaefer 1959: 392). In Inuit women, further attrition results from the practice of chewing hides to soften them (Schaefer 1959: 392). In older women, the teeth may sometimes be worn almost to the gums from this practice (Ferguson 1938: 110).

Each tooth examined for attrition at Kekerten was assigned a score ranging from 0 to 6. The seven stages are: 0 (no attrition), 1 (wear facets only, with no dentine exposure), 2 (small dentine patches visible), 3

(moderate dentine patches visible), 4 (large dentine patches visible), 5 (crown worn away on at least one side), and 6 (roots functional) (the stages are modified from Patterson 1984: 375-376). The results, shown in Table 4, reveal that the Kekerten Inuit exhibited a moderate degree of dental attrition (the greatest number of teeth falling into the Stage 2 category). In contrast, heavier tooth wear appears to have characterized the Niutang and Tasioya burial populations (Salter 1984: 259) although an accurate comparison is difficult since Salter does not indicate the method she used for scoring dental attrition. If the lower degree of attrition observed at Kekerten is, in fact, accurate, it may reflect the increased consumption of European foods which produce less dental wear than the traditional Inuit foods.

Males appeared to exhibit slightly greater attrition than females in both the maxillary and mandibular dentition (see Table 5); however, the sample size is too small to draw any conclusions regarding sex differences.

Hypodontia is a condition in which an individual has fewer than normal teeth. It is more frequent in females than males. Hypodontia is thought to have a genetic basis, although other factors may also play a role in this condition (Patterson 1984: 100). Hypodontia of the deciduous teeth is rare (Pindborg 1970: 21). Among the

Table 4

Dental Attrition - Adult Males and Females

Maxillary Dentition

Score	Left							Tooth								Total	%
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
0																	
1	4	5	3	4	4	1						1	1	1	5	3	32	37.6
2		2	8	2	2	4		2	3		3	1	3	6	2		38	44.7
3			1			1					1			1			4	4.7
4											1						1	1.2
5		1	1	1	1	1				1	2	1		1			10	11.8
6																		
Total																	85	

Dental Attrition - Adult Males and Females

Mandibular Dentition

Score	Left							Tooth								Total	%
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
0																	
1	1	2	1	2	1							1	1		2	2	13	26.5
2			4	2	3	3					1	1	1	5			20	40.8
3							1			1							2	4.1
4	1			1	2	1	1				1		1				8	16.3
5			1			1					1		1		1	1	6	12.2
6																		
Total																	49	

Table 5

Dental Attrition - Adult Males

Maxillary Dentition

Score	Left Tooth								Right Tooth								Total	%
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8		
0																		
1	1	2		2	2							1	1		2		11	26.2
2		1	6	1	1	3		1	2		2		2	4	1		24	57.1
3						1					1						2	4.8
4																		
5			1							1	1	1		1			5	11.9
6																		
Total																	42	

Dental Attrition - Adult Males

Mandibular Dentition

Score	Left Tooth								Right Tooth								Total	%
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8		
0																		
1			1	1	1												3	23.1
2			1	1	1	1								2			6	46.1
3																		
4				1	1												2	15.4
5						1					1						2	15.4
6																		
Total																	13	

Table 5 - continued

Dental Attrition - Adult Females

Maxillary Dentition

Score	Left						Tooth				Right						Total	%
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8		
0																		
1	3	3	3	2	2	1								1	3	3	21	48.8
2		1	2	1	1	1		1	1		1	1	1	2	1		14	32.6
3			1											1			2	4.6
4											1						1	2.3
5		1		1	1	1					1						5	11.6
6																		
Total																	43	

Dental Attrition - Adult Females

Mandibular Dentition

Score	Left						Tooth				Right						Total	%
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8		
0																		
1	1	2		1								1	1		2	2	10	27.8
2			3	1	2	2					1	1	1	3			14	38.9
3							1			1							2	5.6
4	1				1	1	1				1		1				6	16.7
5			1										1		1	1	4	11.1
6																		
Total																	36	

permanent teeth, the mandibular third molar is the most commonly absent tooth, followed by the maxillary lateral incisors, the second premolars, the mandibular central incisors and the maxillary first premolars (Ortner and Putschar 1985: 446). A high incidence of third molar agenesis has been observed in Mongoloid populations (Pindborg 1970: 20).

In the Kekerten sample, Individual #26, an adult female, had hypodontia of the mandibular third molars and a right maxillary premolar, although x-rays would be needed to verify that these teeth were, in fact, congenitally absent and not simply unerupted. In addition, the remaining dentition appeared to be smaller than normal, a condition which has been observed to be associated with third molar agenesis (Patterson 1984: 100). At Niutang, 2 maxillary teeth and 10 mandibular teeth were recorded as being congenitally absent, while at Tasioya, 2 maxillary teeth and 3 mandibular teeth were scored as being congenitally absent although it is not clear how this was determined since the dentition was not x-rayed.

No cases of hyperdontia, or supernumerary teeth, were recorded at Kekerten, Niutang or Tasioya.

Tooth crowding refers to a displacement of the tooth resulting from inadequate space in the maxilla or mandible

to accomodate the dentition (Ortner and Putschar 1985: 447). Two individuals from Kekerten, Individual #72, a young adult female, and Individual #43, an adult male, showed crowding and anterior displacement of the first mandibular premolars and the left central incisor respectively. Collins (1932) examined tooth crowding in 296 living Alaskan Inuit and found that 15.5% of these individuals exhibited tooth crowding. In contrast, his examination of 324 Inuit crania revealed that only 2.8% showed tooth crowding. Based on this observation, Collins suggested that tooth crowding among the Inuit is a recently acquired trait that may be attributed to changed food habits (1932: 458). No tooth crowding was noted in the dentition from Niutang or Tasioya (Salter 1984).

Tooth rotation is an anomaly and probably does not result from inadequate space in the dental arch (Pindborg 1970: 71). While the maxillary second premolar is most often rotated, other teeth affected by this condition include the maxillary incisors and first premolars, and the mandibular second premolars.

Only one case of tooth rotation was observed in the Kekerten remains. The right first maxillary premolar of Individual #61 appears to have been rotated; however, the rotation in this case was likely the result of trauma to the facial region. The presence of new bone growth in the

area of the first premolar supports this conclusion. A middle-aged female from Tasioya had a rotated maxillary second premolar (Salter 1984: 239).

Dental trauma was not common in the Kekerten remains. Only one adult, Individual #26, a young female, had sustained an antemortem crown fracture (see Table 3). In this case, the left second maxillary premolar had sustained a fracture involving the enamel and the dentin. Tooth fractures were noted in other individuals as well; however, they appeared to have occurred postmortem.

A number of adults exhibited dentition with chipped enamel. While some of this chipping may have occurred postmortem, an antemortem occurrence is equally likely. Turner and Cadien (1969) note that this type of wear, which they term "pressure-chipping", is most common in the dentitions of the Inuit of Alaska, Canada and Greenland. They attribute pressure-chipping primarily to the chewing of bone but note that the use of the teeth as tools can also produce this type of wear.

Periodontal disease is "...a disease involving inflammation and degeneration of the periodontium" (Patterson 1984: 84). Clinically, it is classified as either gingivitis, an inflammation of the gingiva or gums, or periodontitis, which involves the formation of bony pockets around the teeth, loss of alveolar bone, and often

tooth loss (Patterson 1984: 85). Periodontal disease usually begins in adolescence. In western societies, it may occur as early as puberty (Goldman and Cohen 1968: 68). The disease is known to affect all populations and is the major cause of antemortem tooth loss in older age groups (Costa 1980: 501). Common irritants which may produce an inflammatory response are plaque and its mineralized counterpart, calculus; however, a number of other factors are also thought to play a role in the development of the disease. These include nutritional deficiencies, tooth morphology, food consistency, trauma, food impaction and poor oral hygiene (Patterson 1984: 84).

In archaeological remains, evidence of periodontal disease can only be assessed by an examination of the alveolar bone. Specific changes in the alveolus include alveolar resorption (recession), deterioration of the thin bony walls between the tooth sockets (the interdental septa) and the presence of infrabony pockets, hollow defects which occur around the tooth roots (Costa 1982).

In the Kekerten remains, only the first characteristic, alveolar resorption, was assessed. The distance between the alveolar margin and the cemento-enamel junction was measured using a cloth measuring tape. Measurements greater than 2 millimeters were considered to indicate periodontal disease (Patterson 1984: 91). It

should be noted here that alveolar resorption may not only result from periodontal disease, but also from caries and periapical abscesses (Ortner and Putschar 1985: 443). Therefore, recession measurements greater than 2 millimeters were attributed to periodontal disease only in cases where there was no evidence of caries or abscesses.

One of the problems associated with this particular method of scoring periodontal disease is that a high degree of dental attrition, such as has been observed in Inuit populations, may be compensated for by the supereruption of the dentition. This supereruption and the resulting increase in the distance between the alveolar margin and the cemento-enamel junction may appear to indicate periodontal disease when, in fact, none exists (Costa 1982: 106-107).

At Kekerten, Individuals #50, an adult male, #26, a young adult female, #1, an adult female, #11, an adult male, #61, an adult male, and #12, an adult female, showed alveolar recession indicating probable periodontal disease. The first four individuals exhibited recession in the maxilla, while the fifth individual showed recession in the mandible. Both the maxilla and the mandible of Individual #12 were involved. Salter (1984: 259) recorded alveolar recession in 4 males and 4 females at Niutang and

2 males, 2 females and 1 individual of unknown sex at Tasioya.

Alveolar abscessing refers to a condition "...characterized by periapical destruction of alveolar bone caused by various infectious conditions" (Patterson 1984: 75). A number of pathological conditions, including caries, periodontal disease, attrition and trauma may lead to the formation of an abscess. Once the pulp cavity is exposed, inflammation of the pulp can occur, leading to infection of the periapical tissues and the creation of an abscess.

One of the problems with diagnosing abscesses in skeletal material is determining the cause of an abscess. This difficulty may be compounded if the tooth has been lost antemortem (Patterson 1984: 76). A second problem is that not all abscesses may be visible upon macroscopic examination. As a result, in a field situation with no x-ray equipment available, the researcher may underestimate the incidence of abscessing in a particular population.

In the Kekerten sample, abscesses were scored following the method used by Patterson (1984: 79-80). Only one adult, Individual #26, a young female, exhibited an abscess. The affected tooth in this case was the left second mandibular premolar. The appearance of the abscess corresponds with Patterson's Stage 4 (radicular cyst).

Abscesses were also uncommon in Salter's burial populations. At Niutang, 17/246 or 6.9% of maxillary teeth and 40/278 or 14.4% of mandibular teeth had abscesses, while at Tasioya, 28/346 or 8.1% of maxillary teeth and 29/396 or 7.3% of mandibular teeth had abscesses (Salter 1984: 258). Without the aid of antibiotics, as would have been the case at Kekerten during the whaling period, infectious organisms might have disseminated through the bloodstream from the affected tooth site to other areas of the body, possibly resulting in death; however, such a process would be difficult to identify in archaeological remains (Ortner and Putschar 1985: 442).

In addition to the alveolar abscess noted above, two other cases of dental infection were observed in the Kekerten skeletal remains. Individual #12, an adult female, exhibited an infection of the alveolus extending into the maxillary sinus at the location of the right second molar. Another adult female, Individual #40, showed extensive periapical bone destruction and exposure of the maxillary sinus in the region of the right premolars and molars.

Miscellaneous Pathologies

One tumor, a button osteoma, was found on the right parietal bone of Individual #12, an adult female. The button osteoma is the most common type of osteoma. It results when "...cells of a circumscribed area of intramembranous bone grow more than the surrounding tissue (Steinbock 1976: 327). Since the cells mature and the growth remains localized, this type of lesion is classified as a benign tumor. It is found primarily on the outer table of the cranial vault, most frequently on the frontal and parietal bones. A single lesion is most common; however, multiple lesions do occur (Ortner and Putschar 1985: 368). Although osteomas are fairly commmon in archaeological remains (Ortner and Putschar 1985: 378), the incidence among Inuit populations is unknown. Salter did not observe any button osteomas in her sample.

Individual #4, a young adult male, exhibited what may be eosinophilic granuloma, one of three clinical manifestations of "...a non-neoplastic histiocytic lesion of unknown etiology" termed histiocytosis X (Ortner and Putschar 1985: 250). The disease is characterized by a proliferation of histiocytes in various organs and tissues. It affects children and young adults and produces solitary or multiple bone lesions. While any

bone may be involved, the skull is the most frequently affected, the characteristic lesion being a solitary, purely lytic, oval or round defect (Ortner and Putschar 1985: 250). Its frequency in Inuit populations is unknown.

Cribra orbitalia, a term used to describe a condition characterized by porous periosteal bone deposition, was observed in Individual #57, child. This type of lesion is found on the skull vault, primarily on the parietal bones and on the orbital roof (Ortner and Putschar 1985: 258). It is thought to result from iron-deficiency anemia, although several other conditions, including leprosy, mumps, nutritional and vitamin deficiencies have also been suggested as causing this type of lesion (Steinbock 1976: 243-246). Cribra orbitalia can affect any population and is more common in children than in adults (Steinbock 1976: 244).

Salter found no evidence of cribra orbitalia in her burial populations. She notes that this finding is not unusual since mineral deficiencies are unknown among Inuit populations who subsist on a diet abundant in fresh meat and fish (Schaefer 1959: 386). The fact that this condition is present at Kekerten suggests that the nutritional level may not have been as good during this time period as it previously was. Perhaps the

introduction of the less nutritional European foods, coupled with periods of famine such as the episodes that occurred at Kekerten in 1909-1910 (Hantzsch 1977: 34), 1923 (Millward 1930: 44) and 1924 (Wight 1925: 56) resulted in mineral deficiencies among these Inuit. Stevenson (personal communication 1988) has suggested that the development of a class structure among the Inuit which he believes to have occurred at Kekerten during the whaling period (Stevenson 1986c) may have resulted in less accessibility by the poorer class to traditional food sources and consequently a greater reliance on Europeans for food, which in turn, may have caused nutritional deficiencies to occur.

Focal periostitis was observed on the anterior surface of the left femoral midshaft of Individual #45, an adult female. As noted in Chapter 5, this lesion may have been caused by some type of localized infectious focus. It is not associated with any other pathological conditions. At Niutang, periostitis, as a separate disease in itself, was found on the shaft of the left humerus of a middle-aged male (Salter 1984: 280). All other cases of periostitis observed at Niutang and Tasioya were associated with other diseases.

Ossification of costal cartilage, resulting in the formation of bony extensions on such elements as the ribs

and sternum, is generally associated with advanced age; however, it can also result from local trauma or infection (Ubelaker 1978: 62). Seven individuals showed ossification of costal cartilage. Individuals #61, an adult male, #66, an adult female, #59, an adult female, and #11, an adult male, exhibited this condition in the manubrium, while Individuals #22, an adult of unknown sex, #12, an adult female, #64, an adult male, and again #59 showed ossification of costal cartilage in the first ribs. Given the ages of Individuals #66, #11, #22, #12 and #64, ossification in these cases is likely age-related. Ossification of costal cartilage in Individual #59 may also be age-related, although this female was assigned an age estimate of only 25 years, a figure that may be too low. The unilateral ossification observed in Individual #61 suggests trauma as a possible cause, particularly considering the extensive evidence of trauma in other areas of this skeleton.

Ossification of ligaments as observed on three left ribs of Individual #12, and fusion of the manubrium and sternal body, as observed in Individuals #1 and #11, are also age-related pathologies.

Rhomboid fossae, depressions found on the sternal inferior surface of the clavicle, represent the location of the attachment of the rhomboid or costo-clavicular

ligament. While they are not strictly pathological, they are mentioned here since they have been recorded in a number of Inuit groups. Rhomboid fossae occur more frequently in males than in females. Among Inuit populations, the trait is significantly more frequent in males (Saunders 1978: 137). It is more common on the right side than on the left and shows a high incidence in adolescence, decreasing with age. The fact that the fossae occur more frequently in males and on the right side suggests that they may be related to robusticity in the developing male (Saunders 1978: 138). In the Kekerten sample, Individuals #43 and #4, both males, exhibited this trait, on the right side only in the first case, and on both sides in the second case.

Another non-pathological feature found in the Kekerten remains were depressions for the attachment of the pectoralis major and teres major muscles of the humerus. Located on the antero-superior surface of the humerus, these impressions occur more frequently in males than in females, and show the highest incidence in adolescence, decreasing with age. Like the rhomboid fossae, impressions for the pectoralis major and teres major muscles may be related to muscular development (Saunders 1978: 170). Individual #43, an adult male, and Individual #65, a probable male, exhibited this feature.

Demographic Reconstruction

In addition to the skeletal evidence, a demographic reconstruction can provide important clues to the health status of the Kekerten Inuit. It should be recognized that such reconstructions are not always reliable, their reliability depending on the accuracy of the age and sex estimates of the individuals in the sample, and the representativeness of the sample (Ubelaker 1978: 91). The second factor is particularly subject to error, with sources of error including inadequate sampling, undetected differential disposal of the dead, and the selection of only complete, well-preserved skeletons (Ubelaker 1978: 91). At Kekerten, the potential for error was reduced by the inclusion in the demographic reconstruction of all skeletons for which age could be estimated (63 individuals in total), although the total sample is, admittedly, still fairly small.

The first step in the reconstruction of the population at Kekerten was to construct a life table (see Table 6) using the estimated age at death of each individual. The age intervals (x) used were selected in order to correspond with those used by Salter (1984: 133), although five-year age intervals are commonly employed in life table constructions in order to compensate for errors

Table 6

Unadjusted Life Table

x	yx	dx	lx	qx	Lx	ex
0-1	7	111	999	.1111	943.5	16.8
1-2	7	111	888	.1250	832.5	17.8
2-5	12	190	777	.2445	2046	19.3
5-10	5	79	587	.1346	2737.5	22.1
10-15	1	16	508	.0315	2500	20.2
15-20	4	63	492	.1280	2302.5	15.7
20-25	3	48	429	.1119	2025	12.7
25-30	11	175	381	.4593	1467.5	8.9
30-35	5	79	206	.3835	832.5	9.4
35-40	1	16	127	.1260	595	8.7
40-45	2	32	111	.2883	475	4.6
45+	5	79	79	1.0000	39.5	0.5
Total	63	999				

in age estimates. The oldest individuals were grouped into a single age interval of 45+ years rather than into more specific intervals since accurate age estimates are difficult to obtain for individuals over 45 years of age (Laughlin, Harper and Thompson 1979: 580). The relatively high number of individuals in the 0-1 year age category whose remains had survived burial (7) suggested that this figure was fairly representative of the actual number of infant deaths. Therefore no correction was made to compensate for missing infant burials. Thus an unadjusted life table was constructed.

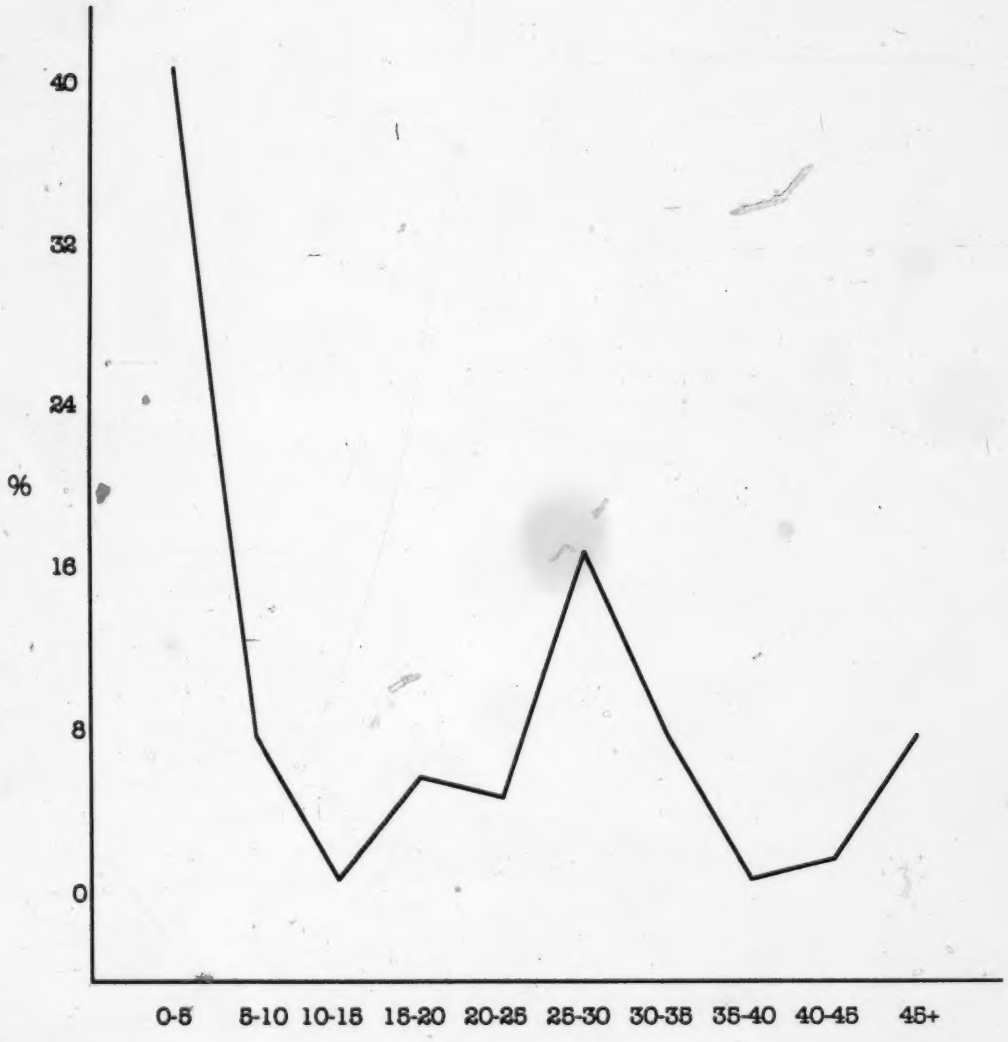
Once the 63 individuals were grouped into the appropriate age intervals, yx representing the number of

individuals falling into each interval, the number of deaths (dx) in each age bracket was calculated. Next the number of survivors entering each interval (lx) was tabulated. From these figures, the probability of death at each age interval was determined (qx), followed by a calculation of the total number of years lived by all individuals during each interval (Lx). Finally, life expectancy values (ex) were calculated.

Next, a mortality curve was constructed for both sexes combined using the number of deaths in each age interval (see Figure 4). Examination of the curve revealed a high death rate of individuals from birth to 5 years of age. Particularly startling is the high number of deaths occurring in the 2 to 5 year age interval (12). This figure contrasts sharply with the number of deaths observed during the same interval at Niutang (1) and at Tasioya (2) (Salter 1984: 133-134). Although the lower number of child burials recorded at the latter 2 sites may have been due, in part, to the loss or disintegration of some of the burials over time, the difference between these two sites and Kekerten seems too large to be explained by this factor alone. One possible explanation is that viral infections introduced into the Inuit population at Kekerten during the whaling period greatly reduced this segment of the population.

Figure 4

Mortality Curve - Both Sexes Combined



As noted in Chapter 2, at least three epidemics occurred at the site during the nineteenth century and early twentieth century. In 1883, an outbreak of diptheria claimed the lives of 5 children (Boas 1964: 18). In 1904-1905, a cholera-like disease resulted in the deaths of several children (Fleming 1932: 102), while seven years later, outbreaks of diptheria and an unidentified skin disease occurred (Fleming 1932: 173). Although viral infections such as diptheria leave no trace in bone (Salter 1984: 226), given the large number of children buried at Kekerten, particularly those in the 2-5 year age range, it is very likely that many of these individuals represent victims of these epidemics. Lacking resistance to these new diseases due to the lack of exposure to the infectious organisms over a long period of time, the Inuit would have readily picked up infection (Robertson 1934: 203). The significantly lower life expectancy at birth at Kekerten (16.8 years) than at Niutang (28.9 years) and Tasioya (30.6 years) (Salter 1984: 133-134) lends further support to the suggestion that Euroamerican contact had a disastrous effect on the health status of the Kekerten Inuit.

The high number of deaths in the 2 to 5 year age interval, as demonstrated by the mortality curve was followed by a dramatic reduction from 5 to 15 years. The

15 to 20 year bracket showed an increase, followed by a slight reduction from 20 to 25 years. A fairly sharp increase characterized the period from 25 to 30 years. This increase was followed by a drop to 40 years, and then an increase through the older age categories.

Examination of male vs. female mortality rates revealed that females exhibit higher death rates than males during the early child-bearing years (15-19 years). Salter (1984: 137) observed the same phenomenon in her burial populations. Female mortality then drops to 25 years of age where it begins to increase, reaching a peak in the 25 to 30 year age interval. Males show a markedly higher mortality rate than females for this age interval, perhaps due to hunting accidents. This peak in male mortality is followed by a sharp decline in the 30 to 35 year age interval. Female mortality, on the other hand, shows a more gradual decline to 40 years of age. In the 45+ age bracket, females demonstrate a higher mortality rate than males.

CHAPTER VII

SUMMARY AND CONCLUSIONS

A detailed examination of forty Inuit skeletons, representing twenty-four adults and sixteen children, revealed that the Kekerten Inuit suffered from a variety of pathological conditions. A number of individuals had sustained fractures, all of which had healed with one exception. Fractures would likely not have been an uncommon occurrence among individuals living in a rugged environment such as the Arctic. In one individual, the presence of extensive fractures suggests that relations among individuals at the whaling station were not always amicable.

Conclusive evidence for tuberculosis was found in only one individual; however, bone changes observed in another individual suggest possible tuberculosis. No other infectious diseases were diagnosed at Kekerten.

Osteoarthritis was fairly common in the skeletal remains. The joints most frequently affected in both sexes were the shoulder, elbow and hip joints, with the females showing greater involvement overall. The right side of the skeleton exhibited higher frequencies of arthritis than the left side.

A number of vertebral pathologies characterized the Kekerten remains. The high frequency of spondylolysis was

not surprising given the fact that this condition has been observed to occur in high frequencies in other Inuit populations. The presence of an extra vertebra, as noted in one individual, has also been reported in other Inuit groups. Two individuals exhibited senile osteoporosis. Osteophytosis was rather uncommon, with a number of older individuals exhibiting no osteophyte development at all. Compression fractures were noted in one individual, an older female, and appeared to be secondary to osteoporosis. One individual had ankylosing spondylitis.

A number of dental pathologies characterized the remains of the Kekerten Inuit. A fairly high number of teeth had been lost postmortem and therefore could not be examined for the presence of disease. The antemortem loss of teeth also prevented their examination for pathologies. A low frequency of dental caries was calculated; however, given the high number of teeth that have been lost postmortem and antemortem, this frequency may not reflect the actual incidence of caries in this population. Dental attrition was moderate. One individual appeared to have hypodontia, although x-rays would have been needed to verify this. Two cases of tooth crowding and one case of tooth rotation were observed. An adult female exhibited an antemortem crown fracture, while a number of other individuals showed chipped enamel, a common characteristic

of Inuit groups that results from the chewing of bones and the use of the teeth as tools. Six cases of alveolar recession, indicating probable periodontal disease, were observed. A low incidence of alveolar abscessing was noted.

Other pathological conditions recorded in the Kekerten Inuit included a button osteoma, cribra orbitalia, eosinophilic granuloma, focal periostitis and ossification of ligaments and costal cartilage, the latter two conditions being age-related.

Unfortunately, accidental deaths, such as deaths from drowning and exposure, leave no evidence in bone; however, given the fact that hunting accidents were quite common among the Inuit (Hantzsch 1977: 43), some of the individuals buried at Kekerten may represent victims of such accidents.

Hantzsch (1977: 34) reported the occurrence of one accidental death at Kekerten. In this case, a man rolled over while sleeping and suffocated his 3-month old son.

The skeletal pathologies found at Kekerten are similar to those recorded by Salter (1984) in the Niutang and Tasioya burial populations. Pathologies observed at the latter two sites include fractures, tuberculosis, osteoarthritis, spondylolysis, osteoporosis, osteophytosis, periostitis, osteomyelitis, dental caries,

hypodontia, tooth rotation, periodontal disease, dental abscesses, and a tumor.

Despite these similarities, there are several differences between the pathologies observed in the Niutang and Tasioya burial populations and those recorded in the Kekerten population that suggest a decline in Inuit health over time. The appearance of iron deficiency anemia at Kekerten suggests that the nutritional level may not have been as good as it previously was, perhaps due to a greater reliance of the Inuit on European foods during this time period and to the food shortages that frequently occurred at the station after the turn of the century.

The introduction of new food items, particularly sugar, may also have contributed to a decline in dental health. The low rate of dental caries observed in the Kekerten remains does not reflect such a decline; however, the calculated frequency may not be accurate given the high number of teeth lost postmortem and antemortem. The significant increase in antemortem tooth loss over time certainly suggests a decline in dental health among the Kekerten Inuit.

Tuberculosis was almost certainly introduced into the Inuit population at Kekerten by European and American whalemen although whether the frequency and severity of

this disease has increased over time cannot be ascertained from the skeletal remains.

Syphilis may very well have been transmitted to the Inuit but no evidence for this disease was noted at Kekerten. Perhaps individuals had a low resistance to this condition and died before the disease reached an advanced stage.

The strongest evidence for the decline in Inuit health during the whaling period appears to lie in the demographic reconstruction of Kekerten. This decline is indicated by the significantly lower life expectancy at birth and the higher number of deaths among children, particularly those aged 2 to 5 years, than at Niutang and Tasioya. The high mortality rate observed in this age interval was very likely the result of epidemics which are known to have claimed the lives of at least eight children at Kekerten during the late 19th and early 20th centuries.

In 1840, Penny estimated the Inuit population in Cumberland Sound to be 1000. Seventeen years later, the native population was estimated at 350 (Holland 1970: 40). These figures suggest that the impact of European and American whalemen on the Inuit may have been most severe during the early years following the rediscovery of the Sound. Unfortunately, historical records for Kekerten are scarce for this time period; however, the occurrence of a

number of cholera-related deaths near Blacklead Island in 1853 (Penny 1854, cited in Holland 1970: 38) and Penny's (1856, cited in Holland 1970: 39) observation that many Inuit had died since the date of his last visit to the Sound suggest that the above statement may be correct. The introduction of alien diseases, the concentration of Inuit into large semi-permanent settlements which made them more susceptible to disease (Ross 1977: 1), and the dietary changes brought about by the introduction of European foods all likely contributed to this decline.

Most of the graves at Kekerten could not be assigned an exact date of burial. Therefore it is not known how many of the graves, if any, represent individuals who died during this early time period. The presence of a large number of rock cairn graves on the east coast of Kekerten Island has led Stevenson (1986b) to suggest that individuals who died during this time period, perhaps as a result of alien diseases introduced by the whalers, may have been buried here, where they migrated in the fall to meet up with whalers as they sailed between the island and the north shore of Cumberland Sound. If this scenario is correct, the graves located in the vicinity of the whaling station may date to a later time period in the station's history.

While Euroamerican contact appears to have had a dramatic impact on the Inuit during the early whaling period in Cumberland Sound, historical records indicate that contact with the whalers continued to have a negative impact on Inuit health in later years. A significant number of deaths appear to have occurred among children during the latter half of the station's occupation, although deaths among adults were also common. While many of these deaths, particularly those of the chldren, were the result of acute illness as indicated by the historical records, some individuals appear to have been chronically ill, surviving into their forties and fifties. Quatsook (personal communication 1987) recalled four elderly women being confined to their tents for long periods of time due to illness. The welfare of the Inuit may have been even more seriously threatened after the turn of the century when there were frequent shortages of food and supplies, a lack of employment opportunities and few ships wintering over at the station.

The analysis of the skeletal pathologies at Kekerten has demonstrated the value of a palaeopathological study in providing important information on the health status of a population, in this case, an historic Inuit population. At the same time, it has raised some interesting questions concerning the effects of Euroamerican contact on Inuit

health. For example, what segment of the population was most severely affected? At what point did the introduction of European foods such as sugar and flour begin to have a significant impact on Inuit dental health? Did nutritional deficiencies become more common as a result of increased reliance on these foods? How has the incidence of tuberculosis changed over time? Does this change in frequency reflect increased resistance to this disease?

There is clearly a need for further palaeopathological analyses of historic Inuit remains in order that the nature and extent of the impact of Euroamerican contact on Inuit health can be determined. Admittedly, the skeletal remains can provide only part of the answer since many of the diseases that may have been introduced to the Inuit leave no trace in bone. Hopefully, historical records, if they exist, can augment the information obtained from the skeletal remains.

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PHOTOGRAPHIC PLATES

Plate 1 Kekerten

Plate 2 A burial in a seaman's chest
(Grave #11 - scale is in centimeters)

Plate 3 A burial in a rifle box
(Grave #35)

Plate 4 A cask burial (Grave #12)

Plate 5 Grave #2

Plate 6 A left rib exhibiting probable eosinophilic granuloma (scale is in centimeters)

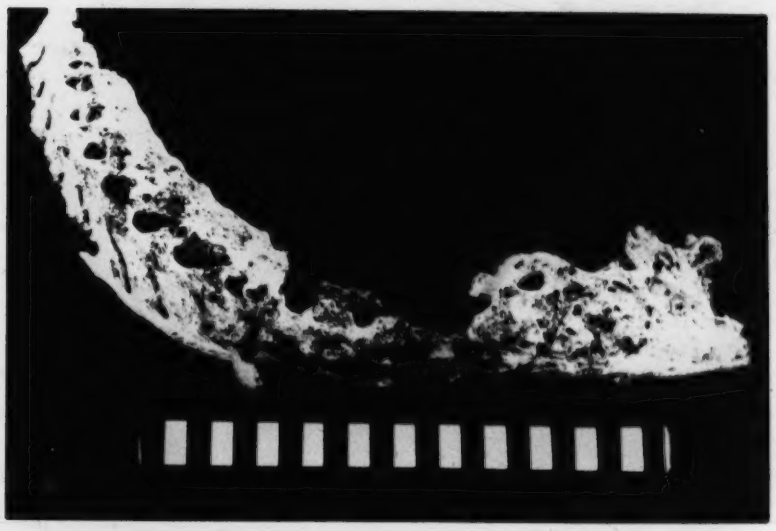


Plate 7 Ankylosing spondylitis of the thoracic and lumbar vertebrae

Plate 8 Thoracic region of the vertebral column exhibiting compression fractures

Plate 9 Maxilla with infection at location of right second molar

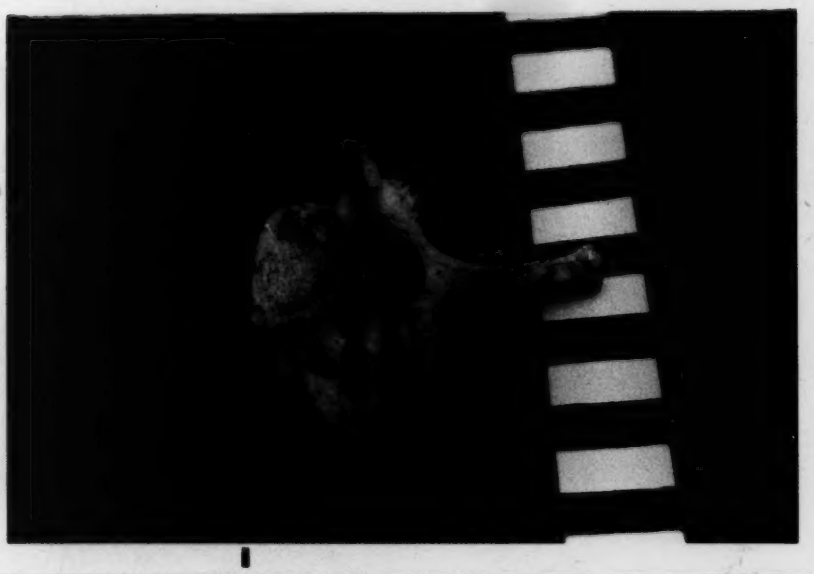


Plate 10 Spondylolysis of the seventh cervical vertebra

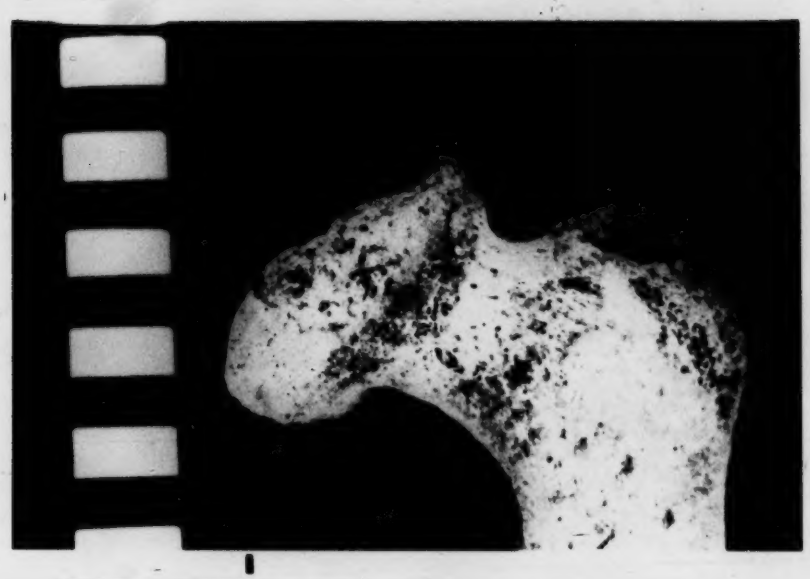


Plate 11 A left femur with probable degenerative arthritis

Plate 12 Maxilla with infection in region of right premolars and molars

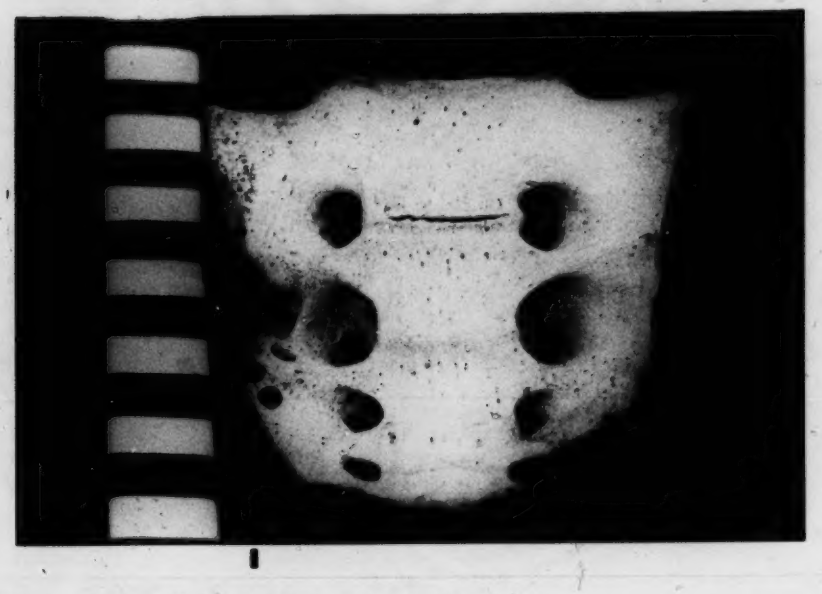


Plate 13 Sacrum with tuberculosis

Plate 14 Left parietal bone exhibiting healed depression fractures

Plate 15 Fracture of the right 12th rib

Plate 16 Fifth lumbar vertebra with bilateral bony growths

APPENDICES

Appendix A

Cranial Measurements - Definitions*

Maximum Length: The greatest length from glabella to opisthocranion (spreading calipers).

Maximum Breadth: The maximum cranial breadth taken above the supramastoid crests perpendicular to the median sagittal plane (spreading calipers).

Basion-Bregma Height: The distance from bregma to basion (spreading calipers).

Basion-Nasion Length: The direct length between nasion and basion (spreading calipers).

Bizygomatic Breadth: The maximum breadth across the zygomatic arches, wherever found, but perpendicular to the median plane (spreading calipers).

Basion-Alveolar Point Length: The direct length between basion and alveolare (spreading calipers).

Upper Facial Height: The distance from prosthion to nasion (sliding calipers).

Maximum Palatal Breadth: The distance between the external surfaces of the alveolar border, taken opposite to the second molar teeth (spreading calipers).

Mastoid Length: The length of the mastoid process measured from a point directly opposite to the upper border of the auditory meatus to the tip of the mastoid process (sliding calipers).

Total Facial Height: The distance from nasion to gnathion with teeth in normal occlusion (sliding calipers).

Minimum Frontal Breadth: The minimum breadth between the right and left temporal crests of the frontal bone (sliding calipers).

Nasal Height: The distance from nasion to nasospinale (sliding calipers).

Nasal Breadth: The distance between the anterior edges of the nasal aperture at its widest extent (sliding calipers).

Orbital Height: The maximum height from the upper to the lower orbital borders perpendicular to the horizontal axis of the orbit and using the middle of the inferior border as a fixed point (sliding calipers).

Orbital Breadth: The maximum distance of the orbit from maxillofrontale to the middle of the lateral orbital border (sliding calipers).

Maximum Palatal Length: The distance from prosthion to alveolon (sliding calipers).

Appendix A - continued

Biasterionic Breadth: The direct measurement from one asterion to the other (sliding calipers).

Minimum Nasal Breadth: The minimum transverse breadth across the two nasal bones (sliding calipers).

Nasion-Bregma Chord: The direct distance from nasion to bregma, taken in the midplane and at the external surface (sliding calipers).

Bregma-Lambda Chord: The direct distance from bregma to lambda, taken in the midplane and at the external surface (sliding calipers).

Lambda-Opisthion Chord: The direct distance from lambda to opisthion taken in the midplane and at the external surface (sliding calipers).

Frontal Arc: The surface distance from nasion to bregma (measuring tape).

Parietal Arc: The surface distance from bregma to lambda (measuring tape).

Occipital Arc: The surface distance from lambda to opisthion (measuring tape).

Fronto-Nasal Breadth: The distance between the lateral edges of the nasal bones taken on the fronto-maxillary suture (sliding calipers).

Glabella-Lambda Length: The length from glabella to lambda (spreading calipers).

Nasion-Lambda Length: The length from nasion to lambda (spreading calipers).

Basion-Lambda Length: The length from basion to lambda (spreading calipers).

Prosthion-Lambda Length: The length from prosthion to lambda (spreading calipers).

Prosthion-Bregma Chord: The distance from prosthion to bregma (spreading calipers).

Bregma-Asterion Chord: The direct distance from bregma to the left asterion (sliding calipers).

Asterion-Lambda Chord: The direct distance from the left asterion to lambda (sliding calipers).

Asterion-Lambda Arc: The surface distance from the left asterion to lambda (measuring tape).

Foramen Magnum Breadth: The transverse distance between the borders of the foramen magnum at its widest extent (sliding calipers).

Foramen Magnum Length: The distance between the anterior and posterior borders of the foramen magnum, taken perpendicular to the breadth (sliding calipers).

Appendix A - continued

Basion-Nasospinale Length: The direct length between basion and nasospinale (spreading calipers).
Basion-Prosthion Length: The length from prosthion to basion (spreading calipers).
Palatal Length: The length from orale to staphylion (sliding calipers).
Palatal Breadth: The greatest transverse breadth between the inner limits of the alveolar arch opposite the second molars (sliding calipers).
Bicondylar Breadth: The maximum distance between the lateral surfaces of the condyles (sliding calipers).
Bigonial Breadth: The maximum distance between the external surfaces of the gonial angles (sliding calipers).
Mandibular Length: The length of the mandible from the most anterior point on the chin in the midline to the posterior edge of the mandibular condyles (goniometer).
Height of Ascending Ramus: The distance from gonion to the uppermost part of the condyle (sliding calipers).
Minimum Breadth of Ascending Ramus: The minimum distance between the anterior and posterior borders of the ascending ramus (sliding calipers).
Height of Mandibular Symphysis: The distance from gnathion to infradentale taken in the midline (sliding calipers).

*Definitions taken from Bass (1971), Giles and Elliot (1963) and Saunders (McMaster Data Base)

Infracranial Measurements - Definitions*

Clavicle

Maximum Length: The greatest distance between the acromial and sternal facets (sliding calipers).
Shaft Diameter: The maximum diameter taken at mid-shaft (sliding calipers).

Scapula

Maximum Length: The greatest distance from the superior angle to the inferior angle (sliding calipers).

Appendix A - continued

Maximum Breadth: The greatest distance from the middle of the glenoid fossa to the point on the vertebral border midway between the two ridges terminating the scapular spine (spreading calipers).

Glenoid Fossa Length: The greatest distance between the upper and lower borders of the articular surface of the glenoid fossa (sliding calipers).

Glenoid Fossa Breadth: The greatest distance between anterior and posterior borders of the articular surface of the glenoid fossa perpendicular to the glenoid length (sliding calipers).

Humerus

Maximum Length: The maximum length from the medial margin of the trochlea to the head of the bone (osteometric board).

Physiological Length: The maximum length from the plane of the condylar surface to the head of the bone (osteometric board).

Maximum Shaft Diameter: The maximum diameter of the shaft at the mid-point of maximum length (sliding calipers).

Minimum Shaft Diameter: The minimum diameter of the shaft at the mid-point of maximum length (sliding calipers).

Maximum Head Diameter: The greatest length on the transverse diameter of the humerus head (sliding calipers).

Minimum Head Diameter: The least breadth on the sagittal diameter of the humerus head (sliding calipers).

Epicondylar Breadth: The maximum distance between the most prominent points on the medial and lateral epicondyles (sliding calipers).

Lower Articular Surface Breadth: The maximum transverse diameter including both trochlea and capitulum (sliding calipers).

Maximum Deltoid Diameter: The maximum diameter of the shaft at the deltoid tuberosity (sliding calipers).

Minimum Deltoid Diameter: The minimum diameter of the shaft at the deltoid tuberosity perpendicular to the maximum deltoid diameter (sliding calipers).

Appendix A - continued

Radius

Maximum Length: The distance between the most widely separated points upon the two extremities of the bone, including the styloid process (osteometric board).

Physiological Length: The distance between the center of the superior articular surface and the nearest point in the concavity of the lower articular surface (spreading calipers).

Head Diameter: The greatest diameter of the radial head (sliding calipers).

Breadth of Distal End: The breadth between the styloid process and ulnar facet, and taken at right angles to the long axis of the bone shaft (sliding calipers).

Ulna

Maximum Length: The distance between the most widely separated points upon the two extremities of the bone, including the olecranon and styloid process (osteometric board).

Physiological Length: The distance from the mid-point of the coronoid articular surface to the most distal point of the lower articular surface of the head; the styloid process is excluded (spreading calipers).

Olecranon Height: The maximum distance between the upper and lower borders of the semi-lunar notch (sliding calipers).

Olecranon Breadth: The maximum distance between the most widely separated points on the two sides of the olecranon process (sliding calipers).

Pelvic Bones

Pelvic Height: The distance from the highest point of the iliac crest to the most distal point on the ischial tuberosity (osteometric board).

Symphyseal Height: The distance from the upper border to the lower border of the symphysis pubis (sliding calipers).

Pubic Length: The maximum length of the pubis from the pubic symphysis to the point in the acetabulum at which the ischium and pubis meet (sliding calipers).

Appendix A - continued

Ischial Length: The maximum length of the ischium from the ischial tuberosity to the point in the acetabulum at which the ischium and pubis meet (sliding calipers).

Maximum Breadth: The distance between the anterior-superior iliac spine and the posterior-superior iliac spine (sliding calipers).

Ramus Width: The width of the ischium-pubis ramus taken from the anterior side of the element at the narrowest point of the ramus inferior to the medial end of the obturator foramen (sliding calipers).

Pubic Body Width: The minimal distance from the centre of the symphyseal rim to the obturator foramen taken from the posterior side of the element (sliding calipers).

Femur

Maximum Length: The greatest distance from the medial condyle at the distal end of the femur to the most proximal point on the head (osteometric board).

Physiological Length: The length taken from both distal condyles to the femoral head, posterior border facing downwards (osteometric board).

Subtrochanteric Sagittal Shaft Diameter: The diameter taken below the lesser trochanter, with the gluteal tuberosity avoided (sliding calipers).

Subtrochanteric Transverse Shaft Diameter: The maximum diameter taken at right angles to the long axis of the shaft at the point where the subtrochanteric lateral expansion is most marked, or at a point from 2 to 5 cm below the base of the lesser trochanter (sliding calipers).

Maximum Head Diameter: The maximum diameter of the articular surface, avoiding abnormal extensions of this surface onto the anterior surface of the neck (sliding calipers).

Anterior-Posterior Diameter of the Mid-Shaft: The maximum anterior-posterior diameter taken at mid-shaft (sliding calipers).

Medio-Lateral Diameter of the Mid-Shaft: The maximum medio-lateral diameter taken at mid-shaft (sliding calipers).

Circumference: The circumference of the shaft taken at the mid-point of maximum length (measuring tape).

Appendix A - continued

Bicondylar Width: The greatest distance between the medial and the lateral epicondyles (sliding calipers).

Patella

Maximum Length: The greatest distance between the base and apex (sliding calipers).
Maximum Breadth: The greatest transverse distance between the lateral and medial sides (sliding calipers).
Maximum Thickness: The greatest thickness between the anterior and posterior surfaces (sliding calipers).

Tibia

Maximum Length: The distance between the most widely separated point upon the upper and lower extremities of the bone; the measurements to include the spine and internal malleolus (osteometric board).
Physiological Length: The distance between the articular surface of the lateral condyle and the surface for articulation with the talus at the lower extremity of the bone or to the base of the internal malleolus corresponding to this level (osteometric board).
Condylar Breadth: The maximum transverse diameter of the upper extremity of bone, measured across, and including both condyles (sliding calipers).
Transverse Cnemic Diameter: The minimal measurement taken at the level of the nutrient foramen (sliding calipers).
Sagittal Cnemic Diameter: The maximum measurement taken at the level of the nutrient foramen (sliding calipers).
Circumference: Circumference of the shaft taken at the level of the nutrient foramen (measuring tape).

Fibula

Maximum Length: The greatest distance between the proximal and distal extremities, including the external malleolus (osteometric board).
Shaft Diameter: The maximum diameter of the shaft taken at mid-shaft (sliding calipers).

Appendix A - continued

Talus

Maximum Length: The greatest distance between the head and the lateral tubercle (osteometric board).
Maximum Breadth: The greatest transverse distance between the lateral process and the medial side (osteometric board).
Height: The vertical distance between the medial condyle and the plane the talus rests upon (osteometric board).

Calcaneus

Maximum Length: The greatest length from the posterior calcaneal point to the anterior calcaneal point (osteometric board).
Maximum Breadth: The greatest transverse breadth across the middle facet and lateral surface (osteometric board).
Minimum Breadth: The minimum breadth anterior to the calcaneal tuberosity (sliding calipers).
Maximum Height: The greatest vertical height from the trochlea to the plane of the bone resting on a flat surface (osteometric board).

Sternum

Sternal Body Length: The greatest distance from the superior point to the inferior point of the mesosternum (sliding calipers).
Manubrium Length: The greatest distance from the superior point to the inferior point of the manubrium (sliding calipers).

*Definitions taken from Bass (1971), Miles (1986), Washburn (1948), Jit et al. (1980), Iscan and Miller-Shaivitz (1984), Black (1978) and Saunders (McMaster Data Base)

Appendix B

Adult Cranial Metrics (mm)

Measurement	#50	#45	#43	#26	#1	#7	#61	#62	#72
Max. Cranial Length	180	174	186	176	188	173	187	183	---
Max. Cranial Breadth	131	131	145	131	141	134	129	139	---
Bas.-Breg. Height	131	133	144	132	139	---	140	127	---
Bas.-Nas. Length	102	107	109	95	103	---	109	101	---
Bizygomatic Breadth	134	---	144	122	(136)	(128)*	136	135	---
Basion-Alv. Length	92	96	104	90	102	---	105	107	---
Pros.-Nas. Height	71	69	76	61	78	---	83	72	---
Maxillo-Alv. Brdth	66	62	67	57	67	---	67	64	---
Mastoid Length	29	(27)	28	32	29	---	27	25	---
Nas.-Gnath. Height	---	123	135	112	---	---	---	---	---
Min. Frontal Breadth	92	94	97	91	96	89	95	100	---
Nasal Height	56	51	52	46	57	---	55	48	---
Nasal Breadth	22	24	22	21	24	---	26	24	---
Orbital Height	35	34	36	33	37	---	37	36	---
Orbital Breadth	43	40	41	38	41	---	43	40	---
Maxillo-Alv. Lngth	47	50	59	52	58	---	58	56	---
Biasterionic Breadth	105	(102)	113	102	113	100	108	105	---
Min. Nasal Breadth	7	9	6	7	3	---	8	8	---
Nas.-Bregma Chord	111	101	116	108	114	---	104	110	---
Breg.-Lambda Chord	107	110	108	112	113	100	118	102	---
Lamb.-Opis. Chord	93	89	104	93	98	91	100	---	---
Frontal Arc	125	113	133	125	130	118	116	127	---
Parietal Arc	120	120	121	123	125	110	132	114	---
Occipital Arc	110	105	124	114	120	115	116	---	---
Fronto-Nasal Breadth	11	12	9	10	3	---	7	(8)	---

Appendix B - continued

Measurement	#50	#45	#43	#26	#1	#7	#61	#62	#72
Glab.-Lambda Length	175	166	177	170	177	163	179	174	---
Nas.-Lambda Length	175	166	178	168	176	161	177	173	---
Bas.-Lambda Length	116	108	124	113	117	---	121	115	---
Pros.-Lambda Length	200	191	212	195	208	---	213	213	---
Pros.-Breg. Chord	165	157	177	163	175	---	171	171	---
Breg.-Aster. Chord	131	130	135	134	142	128	138	126	---
Aster.-Lambda Chord	80	72	84	80	86	79	82	85	---
Aster.-Lambda Arc	86	77	99	90	94	86	90	97	---
Foram. Mag. Breadth	30	26	33	27	32	30	31	31	---
Foram. Mag. Length	39	35	38	37	40	---	39	---	---
Bas.-Nasosp. Length	91	94	100	92	96	---	104	96	---
Bas.-Prosth. Length	91	93	103	91	102	---	107	106	---
Palatal Length	39	43	46	41	44	---	46	45	---
Palatal Breadth	37	39	40	35	37	---	38	40	---
Bicondylar Breadth	---	132	122	112	---	---	126	---	121
Bigonial Breadth	---	109	106	98	---	---	111	---	98
Mandible Length	---	105	114	101	---	---	111	---	101
Height of Asc. Ramus	---	50	63	53	---	---	58	---	53
Min. Brdth Asc. Ramus	---	36	42	37	---	---	38	---	30
Hght. of Mand. Symph.	---	34	42	35	---	---	44	---	34

Measurement	#4	#24	#12	#59	#60	#64	#11	#40
Max. Cranial Length	184	---	189	188	184	178	187	177
Max. Cranial Breadth	142	---	142	139	141	144	145	143
Bas.-Breg. Height	135	(135)	(138)	132	137	141	141	---

Appendix B - continued

Measurement	#4	#24	#12	#59	#60	#64	#11	#40
Bas.-Nas. Length	103	---	102	101	101	106	107	103
Bizygomatic Breadth	138	---	139	138	130	145	142	---
Basion-Alv. Length	100	---	101	95	98	102	100	106
Pros.-Nas. Height	75	65	77	72	77	74	71	68
Maxillo-Alv. Breadth	63	66	(66)	60	63	67	(67)	---
Mastoid Length	23	20	27	28	28	26	26	23
Nas.-Gnath. Height	---	---	111	---	---	---	126	104
Min. Frontal Breadth	96	95	98	94	91	100	97	93
Nasal Height	54	46	54	53	51	55	54	48
Nasal Breadth	21	20	21	23	25	22	23	23
Orbital Height	37	31	37	37	34	36	35	33
Orbital Breadth	39	37	44	40	38	40	43	37
Maxillo-Alv. Length	52	52	57	53	55	55	52	58
Biasterionic Breadth	113	---	107	---	107	111	104	---
Min. Nasal Breadth	7	6	3	7	10	5	8	6
Nas.-Breg. Chord	106	(106)	(110)	108	112	109	112	---
Breg.-Lamb. Chord	104	114	(116)	116	---	---	111	---
Lamb.-Opis. Chord	96	---	(105)	95	---	---	107	103
Frontal Arc	122	---	(122)	123	130	125	126	---
Parietal Arc	131	125	(128)	128	---	---	123	---
Occipital Arc	115	---	(121)	115	---	---	128	119
Fronto-Nasal Breadth	10	7	2	12	12	6	9	6
Glab.-Lamb. Length	177	---	(182)	183	---	---	178	168
Nas.-Lamb. Length	176	---	(182)	182	---	---	179	170
Bas.-Lamb. Length	119	---	123	121	---	---	122	109

Appendix B - continued

Measurement	#4	#24	#12	#59	#60	#64	#11	#40
Pros.-Lamb. Length	205	---	(215)	208	---	---	208	204
Pros.-Breg. Chord	166	---	178	169	178	173	171	---
Breg.-Aster. Chord	136	(130)	134	---	139	130	138	---
Aster.-Lamb. Chord	83	(85)	(86)	---	---	---	88	---
Aster.-Lamb. Arc	91	(98)	(93)	---	---	---	101	---
Foram. Mag. Breadth	31	28	30	32	28	35	32	24
Foram. Mag. Length	36	35	39	40	37	43	33	36
Bas.-Nasosp. Length	91	---	95	84	89	95	(103)	100
Bas.-Prosth. Length	98	---	101	94	97	101	100	104
Palatal Length	44	41	(40)	45	42	39	(44)	---
Palatal Breadth	37	45	(41)	41	39	43	39	---
Bicondylar Breadth	---	---	139	---	---	---	130	---
Bigonial Breadth	---	---	114	---	---	---	102	92
Mandible Length	---	---	---	---	---	---	---	---
Height of Asc. Ramus	---	---	63	---	---	---	60	47
Min. Brdth Asc. Ramus	---	---	39	---	---	---	35	35
Hght. of Mand. Symph.	---	---	26	---	---	---	36	31

*Measurements in parentheses are estimated

Adult Infracranial Metrics (mm) and Indices

Measurement	#22	#23	#50	#45	#43	#26	#1
Clavicle-Max. Length	150	---	(150)*	124	---	127	111
Shaft Diameter	12	---	10	12	---	12	11
Scapula-Max. Length	---	---	---	---	---	143	---
Max. Breath	---	---	---	---	---	94	---
Glen. Fos. Lng.	---	32	(36)	---	---	36	---
Glen. Fos. Brd.	---	23	27	---	---	24	---

Appendix B - continued

Measurement	#22	#23	#50	#45	#43	#26	#1
Humerus-Max. Length	---	259	300	---	301	283	---
Phys. Length	---	255	298	---	300	280	---
Max. Shaft Dia.	---	24	22	---	25	20	---
Min. Shaft Dia.	---	16	17	---	21	16	---
Max. Head Dia.	---	36	---	---	44	40	---
Min. Head Dia.	---	35	---	---	43	36	---
Epicond. Brdth	---	(45)	59	---	62	53	---
Lower Artic. Br.	---	37	47	---	47	38	---
Max. Delt. Dia.	---	24	22	---	26	20	---
Min. Delt. Dia.	---	16	17	---	23	16	---
Radius-Max. Length	208	184	221	190	226	200	(186)
Phys. Length	192	175	208	180	215	187	177
Head Diameter	22	20	23	---	23	19	17
Distal Breadth	35	(26)	33	31	31	28	---
Ulna-Max. Length	220	204	238	213	245	220	207
Phys. Length	193	178	210	188	216	191	183
Olecranon Hght	31	27	31	29	33	28	27
Olecranon Brdth	28	27	33	20	31	26	29
Pelvis-Max. Height	---	181	---	200	---	202	---
Symph. Height	---	45	---	---	---	50	---
Pubic Length	---	83	---	---	---	82	---
Ischial Length	---	76	---	---	---	82	---
Max. Breadth	---	135	---	140	---	157	---
Ramus Width	---	12	---	12	---	13	---
Pubic Body Width	---	32	---	---	---	33	---
Femur-Max. Length	---	353	423	(389)	416	398	---
Phys. Length	---	350	421	384	413	392	---
Subtro. A-P Dia.	---	25	25	23	29	24	---
Subtro. M-L Dia.	---	29	31	27	32	30	---
Max. Head Dia.	---	41	47	41	50	41	---
Midshaft A-P Dia.	---	28	28	27	31	28	---
Midshaft M-L Dia.	---	25	28	24	27	24	---
Shaft Circumfer.	---	83	86	82	90	83	---
Bicondylar Width	---	70	---	---	83	71	---
Patella-Max. Length	43	37	---	40	---	37	---
Max. Breadth	41	39	---	41	---	39	---
Max. Thickness	19	18	---	18	---	17	---
Tibia-Max. Length	---	286	---	---	376	326	---
Phys. Length	---	266	---	---	(360)	310	---
Condylar Breadth	---	(61)	---	---	---	65	---
Trans. Cnem. Dia.	---	20	20	---	27	22	21
Sag. Cnem. Dia.	---	29	33	---	38	27	28
Shaft Circumfer.	---	82	85	---	102	82	82
Fibula-Max. Length	---	273	---	---	364	313	---
Shaft Diameter	---	14	---	---	15	13	---
Talus-Max. Length	55	44	---	---	---	53	---
Max. Breadth	39	(38)	---	---	---	39	---
Max. Height	30	30	---	---	---	28	---
Calcaneus-Max. Length	---	63	---	---	75	67	---
Max. Breadth	---	(37)	---	---	41	39	---

Appendix B - continued

Measurement	#22	#23	#50	#45	#43	#26	#1
Min. Breadth	---	21	---	---	25	23	---
Max. Height	---	40	---	---	44	38	---
Sternum-Mesostern. Lng.	109	111	---	---	101	62	(81)
Manubrium Lng.	---	---	---	---	46	39	(53)
Index of Platymeria	---	86.2	80.6	85.2	90.6	80.0	---
Pilasteric Index	---	112	100	112.5	114.8	116.7	---
Platycnemic Index	---	69.0	60.6	---	71.0	81.5	75.0

Measurement	#67	#72	#7	#78	#66	#61	#62
Clavicle-Max. Length	151	---	---	---	---	146	---
Shaft Diameter	13	---	---	---	---	13	(10)
Scapula-Max. Length	---	---	---	---	---	171	---
Max. Breadth	---	---	---	---	---	96	(88)
Glen. Fos. Lng.	---	---	(40)	---	---	39	36
Glen. Fos. Brd.	---	---	(25)	---	---	27	23
Humerus-Max. Length	---	264	---	267	---	320	---
Phys. Length	---	262	---	264	---	316	---
Max. Shaft Dia.	---	20	---	21	---	23	---
Min. Shaft Dia.	---	13	---	14	---	18	---
Max. Head Dia.	---	(40)	---	39	---	45	---
Min. Head Dia.	---	38	---	---	---	---	---
Epicond. Breadth	---	---	---	53	---	59	---
Lower Artic. Br.	---	35	---	35	---	43	---
Max. Delt. Dia.	---	22	---	23	---	25	---
Min. Delt. Dia.	---	14	---	16	---	20	---
Radius-Max. Length	217	170	---	193	179	236	196
Phys. Length	203	161	---	179	168	223	184
Head Diameter	21	(18)	---	---	(19)	20	---
Distal Breadth	(26)	29	---	29	33	31	29
Ulna-Max. Length	230	(188)	---	207	196	---	---
Phys. Length	204	(164)	---	184	173	---	---
Olecranon Hght	30	(26)	---	26	25	---	---
Olecranon Brdth	28	27	---	29	26	---	---
Pelvis-Max. Height	215	---	---	---	200	221	---
Symph. Height	46	---	---	---	49	45	---
Pubic Length	79	---	---	---	89	84	---
Ischial Length	91	---	---	---	88	95	(84)
Max. Breadth	---	---	---	---	152	168	(138)
Ramus Width	19	---	---	---	17	18	14
Pubic Body Width	31	---	---	---	38	31	---
Femur-Max. Length	420	---	395	---	382	462	393
Phys. Length	419	---	390	---	377	460	390
Subtro. A-P Dia.	26	---	24	---	24	30	26
Subtro. M-L Dia.	35	---	31	---	30	36	32
Max. Head Dia.	47	---	42	---	47	49	---
Midshaft A-P Dia.	28	---	26	---	26	34	31
Midshaft M-L Dia.	30	---	26	---	25	29	27
Shaft Circumfer.	93	---	83	---	80	97	93

Appendix B - continued

Measurement	#67	#72	#7	#78	#66	#61	#62
Bicondylar Width	(72)	---	---	---	70	84	---
Patella-Max. Length	---	---	---	---	43	47	---
Max. Breadth	38	---	---	---	44	44	---
Max. Thickness	20	---	---	---	20	22	---
Tibia-Max. Length	345	---	---	315	301	375	315
Phys. Length	328	---	320	298	281	351	294
Condylar Breadth	---	---	---	(66)	(64)	76	---
Trans. Cnem. Dia.	23	---	21	20	19	27	22
Sag. Cnem. Dia.	35	---	33	29	30	39	32
Shaft Circumfer.	90	---	91	85	83	106	84
Fibula-Max. Length	---	---	---	---	291	360	(297)
Shaft Diameter	---	---	---	---	12	15	12
Talus-Max. Length	---	---	---	53	52	---	---
Max. Breadth	---	---	---	40	44	---	---
Max. Height	---	---	---	30	33	---	---
Calcaneus-Max. Length	---	---	---	72	---	85	---
Max. Breadth	---	---	---	34	---	39	---
Min. Breadth	---	---	---	24	---	27	---
Max. Height	---	---	---	42	46	44	---
Sternum-Mesostern.Lng.	101	---	---	---	---	107	---
Manubrium Lng.	54	---	---	---	45	53	---
Index of Platymeria	74.3	---	77.4	---	80.0	83.3	81.2
Pilasteric Index	93.3	---	100	---	104	117.2	114.8
Platycnemic Index	65.7	---	63.6	69.0	63.3	69.2	68.8

Measurement	#4	#15	#24	#12	#59	#60	#64
Clavicle-Max. Length	138	126	---	148	130	---	(137)
Shaft Diameter	11	9	---	11	10	---	12
Scapula-Max. Length	147	---	129	(149)	---	(152)	163
Max. Breadth	97	---	77	98	---	97	101
Glen. Fos. Lng.	36	---	33	38	---	38	42
Glen. Fos. Brd.	25	---	22	27	---	28	26
Humerus-Max. Length	---	---	---	307	291	---	306
Phys. Length	---	---	---	305	289	---	304
Max. Shaft Dia.	---	---	---	20	23	---	24
Min. Shaft Dia.	---	---	---	15	19	---	19
Max. Head Dia.	---	---	---	43	---	---	44
Min. Head Dia.	---	---	---	41	39	---	38
Epicond. Brd.	---	---	51	55	53	---	63
Lower Artic. Br.	---	---	36	41	43	---	48
Max. Delt. Dia.	---	---	23	21	23	---	24
Min. Delt. Dia.	---	---	14	15	19	---	21
Radius-Max. Length	216	---	---	219	191	202	210
Phys. Length	204	---	---	207	179	187	198
Head Diameter	20	---	---	20	19	21	20
Distal Breadth	30	---	---	31	31	31	28
Ulna-Max. Length	232	212	---	238	211	212	(229)
Phys. Length	202	185	166	210	184	187	202

Appendix B - continued

Measurement	#4	#15	#24	#12	#59	#60	#64
Olecranon Hght	32	29	---	29	29	32	31
Olecranon Brdth	34	23	---	30	28	31	32
Pelvis-Max. Height	201	---	---	---	---	---	217
Symph. Height	---	---	---	---	41	---	46
Pubic Length	---	---	---	---	79	---	88
Ischial Length	(84)	---	---	---	82	---	98
Max. Breadth	(143)	---	---	---	---	---	152
Ramus Width	13	---	---	---	12	---	16
Pubic Body Width	---	---	---	---	33	---	37
Femur-Max. Length	409	---	---	426	378	414	433
Phys. Length	408	---	---	424	377	409	429
Subtro. A-P Dia.	24	---	---	25	25	27	26
Subtro. M-L Dia.	34	---	---	29	31	28	33
Max. Head Dia.	43	---	---	42	41	45	49
Midshaft A-P Dia.	26	---	---	30	26	28	31
Midshaft M-L Dia.	26	---	---	25	27	25	30
Shaft Circumfer.	89	---	---	90	83	87	99
Bicondylar Width	74	---	---	---	73	78	---
Patella-Max. Length	---	35	36	37	37	38	45
Max. Breadth	---	39	35	44	37	42	43
Max. Thickness	---	18	17	19	19	20	21
Tibia-Max. Length	342	---	---	---	---	---	345
Phys. Length	(320)	---	---	---	---	---	(320)
Condylar Breadth	73	---	---	---	---	---	75
Trans. Cnem. Dia.	20	---	---	---	---	21	21
Sag. Cnem. Dia.	32	---	---	---	---	30	35
Shaft Circumfer.	90	---	---	---	---	85	95
Fibula-Max. Length	325	---	(276)	315	---	---	324
Shaft Diameter	15	---	12	13	---	---	15
Talus-Max. Length	52	---	48	51	51	57	55
Max. Breadth	46	---	37	40	43	43	42
Max. Height	33	---	29	30	31	32	34
Calcaneus-Max. Length	71	---	63	(67)	---	72	79
Max. Breadth	---	---	36	---	---	40	40
Min. Breadth	---	---	21	---	---	27	26
Max. Height	44	---	40	---	---	46	49
Sternum-Mesostern. Lng.	117	93	---	---	103	108	102
Manubrium Lng.	---	42	---	(37)	38	40	55
Index of Platymeria	70.6	---	---	86.2	80.6	96.4	78.8
Pilasteric Index	100	---	---	120	96.3	112	103.3
Platycnemic Index	62.5	---	---	---	---	70.0	60.0

Measurement	#65	#11	#40
Clavicle-Max. Length	---	131	(130)
Shaft Diameter	---	13	12
Scapula-Max. Length	---	---	---
Max. Breadth	---	94	---
Glen. Fos. Lng.	---	38	34
Glen. Fos. Brd.	---	26	22

Appendix B - continued

Measurement	#65	#11	#40
Humerus-Max. Length	---	256	---
Phys. Length	---	250	---
Max. Shaft Dia.	---	21	---
Min. Shaft Dia.	---	18	---
Max. Head Dia.	---	---	---
Min. Head Dia.	---	---	---
Epicond. Breadth	---	51	---
Lower Artic. Br.	---	42	---
Max. Delt. Dia.	---	20	---
Min. Delt. Dia.	---	19	---
Radius-Max. Length	204	---	180
Phys. Length	190	---	164
Head Diameter	20	---	19
Distal Breadth	33	---	29
Ulna-Max. Length	---	214	---
Phys. Length	---	187	---
Olecranon Hght	---	---	---
Olecranon Brdth	---	---	---
Pelvis-Max. Height	---	---	---
Symph. Height	---	42	---
Pubic Length	---	71	---
Ischial Length	---	---	---
Max. Breadth	---	130	---
Ramus Width	---	10	---
Pubic Body Width	---	25	---
Femur-Max. Length	415	---	366
Phys. Length	410	---	363
Subtro. A-P Dia.	27	---	23
Subtro. M-L Dia.	35	---	26
Max. Head Dia.	48	48	39
Midshaft A-P Dia.	27	---	24
Midshaft M-L Dia.	28	---	23
Shaft Circumfer.	85	---	76
Bicondylar Width	---	---	69
Patella-Max. Length	---	---	39
Max. Breadth	---	---	41
Max. Thickness	---	---	20
Tibia-Max. Length	---	---	288
Phys. Length	---	---	269
Condylar Breadth	---	---	62
Trans. Cnem. Dia.	---	---	18
Sag. Cnem. Dia.	---	---	27
Shaft Circumfer.	---	---	78
Fibula-Max. Length	320	---	---
Shaft Diameter	13	---	---
Talus-Max. Length	56	53	---
Max. Breadth	44	40	---
Max. Height	34	30	---
Calcaneus-Max. Length	---	69	---
Max. Breadth	---	41	---
Min. Breadth	---	26	---

Appendix B - continued

Measurement	#65	#11	#40
Max. Height	---	41	---
Sternum-Mesostern. Lng.	---	(99)	---
Manubrium Lng.	---	(50)	42
Index of Platymeria	77.1	---	88.5
Pilasteric Index	96.4	---	104.3
Platycnemic Index	---	---	66.7

*Measurements in parentheses are estimated

Appendix C

Human Remains Field Recovery Form*

Investigator_____
Date_____
Burial No._____
Site_____

1. LOCATION
   a. Square_____
   b. Horizontal_____
   c. Depth from surface_____
   d. Depth from datum_____

2. BURIAL TYPE
   a. Extended_____
   b. Flexed_____
   c. Semiflexed_____
   d. Reburial_____
   e. Cremation_____
   f. Part cremation_____
   g. Other_____

3. BURIAL DIMENSIONS
   a. Max. length_____
   b. Max. width_____
   c. Thickness_____

4. DEPOSITION
   a. Position_____
   b. Head to_____

5. GRAVE TYPE
   a. Surface_____
   b. Pit_____
   c. Cist_____
   d. Other_____
   e. Shape_____

6. GRAVE DIMENSIONS
   a. Max. length_____
   b. Max. width_____
   c. Depth_____

7. ASSOCIATIONS
   a. Artifacts_____
   _____
   _____
   _____
   b. Faunal_____
   _____
   _____

Appendix C - continued

8. PRESERVATION
   a. Poor_____Fair_____Good_____
   b. State of decomposition_____
   _____

9. COMPLETENESS
   _____

10. SEX
    a.Male_____Female_____Indeterminate_____

11. AGE
    a. Infant_____ d. Adult_____
    b. Child_____ e. Mature_____
    c. Adolescent_____ f. Indeterminate_____

12. RACE
    _____

13. DEGREE OF DISTURBANCE
    _____
    _____
    _____

14. REMARKS
    _____
    _____
    _____

* adapted from the Smithsonian Institution River Basin Surveys Burial Form in Bass 1971: 259.

Appendix C - Continued

Skeletal Inventory Form

Date_____
Burial No._____

Bone	Present	Absent	Fragmented (Describe)
Cranial:			
frontal			
occipital			
sphenoid			
mandible			
ethmoid			
vomer			
hyoid			

	Left	Right	Fragmented (Describe)
parietal			
temporal			
maxilla			
nasal			
zygomatic			
lacrimal			
palate			
inf. nasal concha			
malleus			
incus			
stapes			

	Present	Absent	Fragmented (Describe)
Postcranial:			
cervical vertebrae-			
atlas			
axis			
3-6			
7			

Appendix C - continued

	Present	Absent	Fragmented (Describe)
thoracic vertebrae-			
1			
2-9			
10			
11			
12			
lumbar vertebrae-			
1			
2-5			
sacrum			
coccyx			
sternum-			
sternal body			
manubrium			

Bone	Left	Right	Fragmented (Describe)
scapula			
clavicle			
ribs-			
1			
2			
3-10			
11			
12			
humerus			
radius			
ulna			
carpals-			
navicular			
lunate			
triquetral			
pisiform			
trapezium			
trapezoid			
capitate			
hamate			
metacarpals-			
1st			
2nd			

Appendix C - continued

Bone	Left	Right	Fragmented (Describe)
3rd			
4th			
5th			
phalanges-			
proximal			
middle			
distal			
innominate			
femur			
patella			
tibia			
fibula			
tarsals-			
talus			
calcaneus			
1st cuneiform			
2nd cuneiform			
3rd cuneiform			
navicular			
metatarsals-			
1st			
2nd			
3rd			
4th			
5th			
phalanges			
proximal			
middle			
distal			

Appendix D

Incidence of Non-Metric Cranial Traits in Adults

Cranial Trait	#50	#45	#43	#26	#1	#7	#61	#62
Mylohyoid Bridging	-/-*	A/A	A/A	A/A	-/-	-/-	A/A	-/-
Infraorb. For. Div.	A/A	A/A	A/A	A/A	P/A	-/-	A/P	A/A
Palatine Bridging	A/A	A/A	A/A	A/A	A/A	-/-	A/A	A/A
Hypoglos. Can. Div.	A/A	A/A	A/A	A/P	A/A	-/-	A/A	A/P
Supraorb. Foramen	P/P	A/P	A/A	A/A	A/P	P/A	A/P	A/A
Trochlear Spurring	A/A	A/A	A/A	A/A	-/-	-/-	A/A	A/A
Ossified Apical Lig.	A	A	A	A	A	-	A	A
Bregmatic Wormian	A	A	A	A	A	A	A	A
Sagittal Wormian	A	A	A	A	A	A	A	A
Coronal Wormian	-/-	A/A	-/-	A/A	A/A	-/-	P/A	A/A
Lambdic Wormian	A	A	A	A	A	A	A	A
Lambdoidal Wormian	A/A	P/A	-/-	P/P	P/P	P/-	A/A	P/A
Parietal Notch	A/P	-/A	A/A	A/P	A/A	A/A	A/A	A/P
Inca Bone	A	A	A	A	A	A	A	A
Asterionic Wormian	A/A	-/A	P/-	A/A	A/A	A/A	A/A	A/A
Epipteric Wormian	A/A	-/A	A/-	A/A	A/A	-/-	P/A	A/A
Occipito-Mast. Worm.	A/A	-/A	A/-	A/A	A/A	A/A	A/A	A/A
Premaxillary Suture	A	A	A	A	A	-	A	A
Metopic Sut. (trace)	A	A	A	P	P	A	A	P
Access. Mental For.	-/-	A/A	A/A	A/A	-/-	-/-	A/A	-/-
Parietal Foramen	P/P	P/P	-/-	A/A	A/P	P/P	A/A	-/-
Post. Condylar Canal	P/P	P/P	A/A	P/P	P/P	-/-	P/P	P/P
Mastoid For. Exsut.	-/A	-/-	P/-	A/P	P/P	A/P	A/P	-/P
Foramen Ovale Open	A/A	-/A	A/A	A/A	A/A	P/A	A/A	A/A
Foramen Spin. Open	A/P	-/A	A/P	A/A	A/A	P/A	A/A	A/A
Tympanic Dehiscence	A/A	-/A	A/A	P/P	A/A	P/P	P/P	P/P
Pharyngeal Fossa	A	A	A	A	A	-	A	A
Os Japonicum	A/A	-/A	A/-	A/A	A/-	-/-	A/A	A/A
Pterygo-Basal Bridg.	P/A	-/A	A/A	A/A	A/A	-/-	A/A	A/A
Clino-Clinoid Bridg.	A/A	-/-	-/-	-/-	-/-	-/-	-/-	-/-
Carotico-Clin. Brid.	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
Intermed. Cond. Can.	A/A	A/A	A/A	A/A	A/A	-/-	A/A	A/A
Access. Optic Canal	A/A	-/-	A/A	A/A	-/-	-/-	A/A	-/-
Frontal Grooves	A/A	A/A	-/-	A/A	A/A	A/A	A/A	A/A
For. Lat. Pter. Pl.	A/A	-/-	A/A	A/A	A/A	-/-	A/A	A/A
Spino-Basal Bridg.	A/A	-/A	A/A	A/A	A/A	-/-	A/A	A/A
Pariet. Proc. Temp.	A/A	-/A	A/A	A/A	A/A	A/A	A/A	A/A
Access. Mand. Foram.	-/-	A/A	P/A	A/A	-/-	-/-	A/A	-/-
Fronto-Temp. Artic.	A/A	-/A	A/A	A/A	A/A	A/A	A/A	A/A
Infraorbital Suture	P/P	A/A	P/-	P/P	A/A	-/-	P/P	P/P
Marginal Foramen	A/A	-/A	A/A	A/A	A/A	A/A	A/A	A/A

Cranial Trait	#4	#24	#12	#59	#60	#64	#11	#40
Mylohyoid Bridging	-/-	-/-	A/A	-/-	-/-	-/-	A/A	A/A
Infraorb. For. Div.	A/A	A/A	A/A	A/A	A/A	A/A	-/-	A/A
Palatine Bridging	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A
Hypoglos. Can. Div.	A/A	A/A	A/A	P/A	A/A	A/P	A/A	A/A
Supraorb. Foramen	P/P	P/P	A/A	P/P	P/P	A/P	A/A	A/A

Appendix D - continued

Cranial Trait	#4	#24	#12	#59	#60	#64	#11	#40
Trochlear Spurring	A/A	A/A	A/A	A/A	A/A	A/A	-/-	A/A
Ossified Apical Lig.	A	A	A	A	A	A	P	A
Bregmatic Wormian	A	A	-	A	A	A	A	-
Sagittal Wormian	A	A	-	A	-	-	A	-
Coronal Wormian	A/A	A/A	-/-	A/P	-/-	-/-	-/-	-/-
Lambdic Wormian	A	A	-	A	-	-	A	A
Lambdoidal Wormian	P/P	P/P	-/-	A/A	-/-	P/P	A/-	-/-
Parietal Notch	A/P	P/-	A/A	A/-	A/A	A/A	A/A	-/-
Inca Bone	A	A	A	A	A	A	A	A
Asterionic Wormian	A/A	P/-	A/A	A/A	A/A	A/P	A/A	-/-
Epipteric Wormian	A/A	-/-	A/A	P/P	A/P	-/-	-/-	-/-
Occipito-Mast. Worm.	A/A	A/-	A/A	-/-	-/P	A/A	A/A	-/-
Premaxillary Suture	T	T	A	A	A	A	A	A
Metopic Sut. (trace)	P	P	A	A	A	A	P	A
Access. Ment. For.	-/-	-/-	A/A	-/-	-/-	-/-	A/A	A/A
Parietal Foramen	A/P	P/A	P/P	P/A	P/A	A/P	P/P	P/P
Post. Condylar Can.	P/P	A/P	P/P	P/P	P/A	P/P	P/P	P/P
Mastoid For. Exsut.	P/P	A/P	A/A	-/-	A/A	A/A	A/P	-/-
Foramen Ovale Open	A/A	P/A	A/A	A/A	A/A	A/A	A/A	A/A
Foramen Spin. Open	P/A	A/A	A/A	A/A	A/P	P/P	A/P	A/A
Tympanic Dehiscence	P/P	A/A	A/A	A/A	A/A	A/A	P/P	P/A
Pharyngeal Fossa	A	A	A	A	A	A	-	A
Os Japonicum	A/A	A/A	A/A	A/A	A/A	A/A	A/A	-/A
Pterygo-Bas. Brid.	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A
Clino-Clinoid Brid.	-/-	A/A	-/-	-/-	-/-	-/-	-/-	-/-
Carotico-Clin. Brid.	-/-	A/A	-/-	-/-	-/-	-/-	-/-	-/-
Intermed. Cond. Can.	A/A	A/A	A/A	A/A	A/A	A/A	-/-	A/A
Access. Optic Canal	A/A	P/P	P/P	A/A	A/A	A/-	-/-	A/A
Frontal Grooves	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A
For. Lat. Pter. Pl.	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A
Spino-Basal Brid.	A/A	A/A	A/A	A/A	A/A	P/A	A/A	A/A
Parietal Proc. Temp.	A/A	A/A	A/A	A/A	A/A	A/A	A/A	-/-
Access. Mand. Foram.	-/-	-/-	A/A	-/-	-/-	-/-	A/A	A/A
Fronto-Temp. Artic.	A/A	-/-	A/A	A/A	A/A	A/A	-/-	-/-
Infraorbital Sut.	P/P	P/P	A/A	P/P	T/P	A/P	A/P	A/A
Marginal Foramen	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A

*
/=left/right
A=Absent
P=Present
T-Trace

Appendix E

Discriminant Function Analysis Values

	Cranium		Mandible	
Indiv.	Giles and Elliot '63 (Function #1)	Hanihara '59	Giles '64 (Function #1)	Hanihara '59
#1	2892.121	609.4462	---------	---------
#4	2853.696	600.4358	---------	---------
#11	2931.729	619.4686	290.28	417.9874
#12	2918.585	612.2886	295.292	423.1733
#26	2666.136	567.416	268.762	394.4529
#40	---------	---------	243.378	358.4695
#43	3004.334	626.578	309.532	455.9587
#45	---------	---------	271.46	392.6966
#50	2812.946	584.6298	---------	---------
#59	2896.445	599.0256	---------	---------
#60	2786.126	594.1758	---------	---------
#61	2956.944	611.0556	305.792	443.991
#62	2780.588	580.9288	---------	---------
#64	2962.014	614.3004	---------	---------
#72	---------	---------	267.372	380.5065

Appendix F

Diaphyseal Length of the Long Bones and Maximum Width of the Ilium (mm)

Indiv.	Humerus		Radius		Ulna		Femur		Tibia		Fibula		Ilium	
	L	R	L	R	L	R	L	R	L	R	L	R	L	R
#2	51	---	---	41	48	---	57	---	---	---	45**		---	---
#8	---	---	---	---	---	---	---	---	---	---	---	---	---	---
#14	---	---	49	50	56	56	78	---	---	---	---	---	36	---
#16	203	206	140	---	156	---	286	---	235	---	230	230	107	104
#17	---	---	---	---	---	---	---(260)*		---	233	210		94	---
#18	---	153	---	---	---	---	211	211	166	167	170	170	(80)	(80)
#27	---	---	(53?)***		(53?)		---	---	---	---	---	---	(31)	---
#28	150	152	---	114	---	127	214	214	183	176	---	---	82	---
#32	---	---	---	---	---	---	---	---	---	---	192		---	---
#33	134	(135)	---	(90)	---	115	---	---	---	---	---	---	---	70
#34	---	138	---	---	---	104	176	---	---	139	---	---	70	---
#35	132	---	92	---	104	105	---	177	---	142	---	---	---	72
#36	---	132	---	100	---	109	173	173	(141)	145	---	---	72	---
#37	---	---	---	---	---	---	111	106	87	---	---	---	---	---
#38	---	---	129	---	---	---	---	---	---	---	---	---	90	---
#41	---	---	---	---	---	---	---	---	165	---	---	---	85	---
#47	160	---	---	111	---	125	224	221	---	---	(176)		90	---
#49	---	70?	---	---	---	---	---	70?	---	---	---	---	---	---
#51	---	(174)	---	---	---	---	243	---	---	---	(185)		---	94
#53	---	---	---	---	---	(71)	---	---	---	---	---	---	---	---
#57	---	127	---	---	---	---	163	165	(135)	(135)	---	---	---	---
#68	---	---	---	---	---	---	---	---	305	---	---	---	---	---
#74	---	---	---	---	---	---	---	---	145	145	---	---	---	---
#85	57?	57?	---	---	---	---	57?	57?	---	---	---	---	---	---
#86	(61)		---	---	---	---	---	---	---	---	---	---	---	---

*Measurements in parentheses are estimated

**Numbers positioned halfway between the left and the right sides indicate that the side of the bone is unknown

***Numbers with question marks beside them indicate that it is uncertain which bone it is

Appendix G

Summary of Pathologies by Type

Trauma

Individual	Bone	Location	Type
#4	L4	right pars interarticularis	fatigue fracture
#7	right radius	distal end of shaft	fracture
#40	right femur	proximal shaft, neck	fracture
#50	middle and distal phalanges of 5th finger	joint	fracture?
#61	frontal bone		depressed fracture
	parietal bones		depressed fractures
	occipital bone		depressed fracture
	nasal bones		fracture
	right maxillary bone	orbital floor	blow-out fracture?
	a left rib	costal end	fracture
	a left rib	costal end	fracture
	a rib fragment	costal end	fracture
#64	right 12th rib	shaft	fracture

Infectious Diseases

Individual	Bone	Location of Lesion	Type
#60	sacrum	right auricular surface	tuberculosis

Appendix G - continued

Infectious Diseases

Individual	Bone	Location of Lesion	Type
#66	manubrium	anterior, left side	
	a thoracic vertebra	superior and inferior body	
	a lumbar vertebra	inferior body	
	right 2nd rib	midshaft	tuberculosis?

Osteoarthritis

Individual	Bone	Location
#1	L4	right inferior articular facet
	axis	dens
	T12	right inferior articular facet
#4	L5	left inferior articular facet
#11	left scapula	glenoid fossa
	left clavicle	sternal articular surface
	mesosternum	costal cartilage notches
	left humerus	head
	right humerus	head and trochlea
	radii	head
	pelvic bones	acetabulae
	atlas	dens facet
	C6	superior body, superior articular facets
	C7	inferior body, inferior facets
#12	skull	right occipital condyle

Appendix G - continued

Osteoarthritis

Individual	Bone	Location
#12	skull	right mandibular fossa
	clavicles	acromial and sternal articular surfaces
	scapulae	acromioclavicular joints, glenoid fossae
	left humerus	head, trochlea and capitulum
	right humerus	head, trochlea, capitulum, radial and coronoid fossae
	radii	head
	ulnae	olecranon processes
	right pelvic bone	acetabulum
	left patella	medial articular facet
	right 1st rib	head and articular facet of tubercle
	left 1st rib	head and articular facet of tubercle
	right 2nd rib	head, articular and non-articular part of tubercle
	left 2nd rib	articular facet of tubercle
	6 right ribs	head and articular facet of tubercle
	right 12th rib	head
	7 left ribs	head (7 ribs), articular facet of tubercle (2 ribs)
	atlas	dens facet
	axis	dens, left inferior articular facet
	C3	left superior articular facet
	C4	body

Appendix G - continued

Osteoarthritis

Individual	Bone	Location
#12	C5	body
	C6	body
	C7	body
	T1	transverse facets, superior body
	T2	transverse facets, superior body
	T4	left inferior costal facet
	T5	right inferior costal facet
	T10	superior articular facets
	T11	superior articular facets, right costal facet
	T12	superior articular facets
	L5	inferior articular facets
	sacrum	articular facets
	1st metacarpals	proximal facets
	right 3rd metacarpal	distal articular surface
	4th metacarpals	distal articular surface
	left 5th metacarpal	proximal facet
	proximal phalanx	distal articular surface
	middle phalanx	distal articular surface
	3 distal phalanges	proximal facet
	right trapezium	
#22	right radius	head
	left femur	head
	sacrum	right articular facet
	right clavicle	sternal and acromial articular surfaces

Appendix G - continued

Osteoarthritis

Individual	Bone	Location
#22	mesosternum	costal cartilage facets
	right 12th rib	head
	a left rib	head
	a left rib	head
	a left rib	head
	a right rib	head
	atlas	dens facet
	axis	dens, inferior body
	a thoracic vertebra	costal facets
	a thoracic vertebra	costal facets
	T11	inferior articular facets
	T12	inferior articular facets
	L3	superior and inferior articular facets
	1st distal phalanx of foot	proximal articular facet
	C7	right superior body
#23	left ulna	olecranon
	a thoracic vertebra	right inferior costal facet
	right scapula	acromioclavicular joint
	right clavicle	acromial articular surface
#40	manubrium	clavicular notches
	right pelvic bone	auricular surface, acetabulum
	left tibia	fibular notch
	skull	occipital condyles
	axis	right inferior articular facet
	C3	right superior articular facet
	C4	inferior body

Appendix G - continued

Osteoarthritis

Individual	Bone	Location
#40	C6	inferior articular facets
	C7	superior and inferior articular facets
	T12	left inferior articular facet
	a lumbar vertebra	inferior articular facets
	a lumbar vertebra	inferior articular facets
	L5	superior and inferior articular facets
#43	a right rib	articular facet of tubercle
#45	a thoracic vertebra	right inferior articular facet
#50	a thoracic vertebra	right superior articular facet
#59	mesosternum	costal cartilage notches
	left humerus	inferior articular surface
	left radius	head
	right clavicle	acromial articular surface
	1st ribs	head
	a left rib	articular surface of tubercle
#59	axis	left inferior articular facet

Appendix G - continued

Osteoarthritis

Individual	Bone	Location
#59	C3	left superior articular facet, right inferior articular facet
	L5	right inferior articular facet
	a lumbar vertebra	inferior articular facets
#60	a left rib	articular facet of tubercle
#61	femora	head
	a thoracic vertebra	right inferior articular facet
	left 1st rib	head and tubercle
	mesosternum	costal cartilage facets
	a thoracic vertebra	right superior articular facet
	a lumbar vertebra	right inferior articulr facet
	right clavicle	acromial articular surface
#62	a thoracic vertebra	right inferior articular facet
#64	C6	superior body
	L4	inferior articular facets
#65	a lumbar vertebra (L2 or L3)	inferior articular facets
#66	right patella	medial articular facet

Appendix G - continued

Osteoarthritis

Individual	Bone	Location
#66	right clavicle	sternal articular surface
	atlas	dens facet
	a lumbar vertebra	inferior articular facets
	a lumbar vertebra	superior and inferior articular facets
#67	right 1st rib	articular facet of tubercle
	a left rib	head
	a right rib	articular facet of tubercle
	a right rib	articular facet of tubercle
	a right rib	articular facet of tubercle and head
#78	right patella	medial articular facet

Pathologies of the Vertebral Column

Vertebral Arch Defects

Individual	Bone	Location
#1	L5	right and left pars interarticularis
#16	L5	spinous process
#22	C7	left pars interarticularis
#26	L5	spinous process and left pars interarticularis
	S1	spinous process

Appendix G - continued

Pathologies of the Vertebral Column

Vertebral Arch Defects

Individual	Bone	Location
#38	atlas	right side, posterior to facet
#51	S1	spinous process
#61	a lumbar vertebra	spinous process
#67	L5	right and left pars interarticularis
#72	sacrum	S1 and S2 spinous processes

Compression Fractures

Individual	Bone	Location
#12	T6	anterior and posterior body
	T11	anterior body
	L4	anterior body

Osteophytosis

Individual	Bone	Location
#12	C4	inferior body
	C5	superior and inferior body
	C6	superior and inferior body
	C7	superior body

Appendix G - continued

Osteophytosis

Individual	Bone	Location
#12	L2	superior and inferior body
	L3	superior and inferior body
	L4	superior and inferior body
#22	T11	inferior body
	T12	superior body
#59	T6	inferior body
	T7	superior body
#65	T11?	inferior body

Osteoporosis

Individual	Bone	Location
#12	T8	body
	T9	body
	T10	body
	T11	body
	L4	body
#22	T11	body
	T12	body

Appendix G - continued

Other Pathologies of the Vertebral Column

Individual	Bone	Location	Description
#1	L4		an extra facet adjacent and inferior to left inferior articular facet
#4	a thoracic vertebra	inferior body	depression
	a thoracic vertebra	inferior body, spinous process	depression, deviated spinous process
#7	a lumbar vertebra		pit below right superior articular facet
#11	atlas	articular facets	atlas fused to occipital condyles - ankylosing spondylitis
	C6 and C7	anterior body, articular facets	ankylosing spondylitis
	thoracic and lumbar vertebrae	anterior bodies, spinous processes, articular facets	ankylosing spondylitis
#12	atlas	dens facet	ossification of anterior longitudinal ligament
	T7	spinous process	ossification of supraspinous ligament
	T8	spinous process	ossification of supraspinous ligament

Appendix G - continued

Other Pathologies of the Vertebral Column

Individual	Bone	Location	Description
#12	L5	spinous process	deviated spinous process
#16	vertebral column		an extra thoracic vertebra
#22	a cervical vertebra	spinous process	deviated spinous process
#24	L5	inferior transverse processes	facets for articulation with sacrum
#26	T8	inferior body	depression
	T10	inferior body	depression
#38	a thoracic vertebra	left inferior articular facet	pit
	a thoracic vertebra	inferior articular facets	pit
	a thoracic vertebra	right inferior articular facet	pit
#40	L5	right inferior articular facet, right transverse process	bony growths from facet to process
#43	a thoracic vertebra	body and spinous process	pit on inferior body, deviated spinous process

Appendix G - continued

Other Pathologies of the Vertebral Column

Individual	Bone	Location	Description
#59	a lumbar vertebra	spinous process	deviated spinous process, also a pit below left superior articular facet
#61	a thoracic vertebra		ossification of ligamentum flavum
#64	a lower thoracic vertebra	left inferior articular facet	facet expanded, indistinct
	L5	inferior articular facets, transverse	bony growths from facets to processes
#65	a thoracic vertebra L1 or L2	inferior body	depression
		superior body	depression,
	a thoracic vertebra	left inferior articular facet	expanded facet
#66	a thoracic vertebra	superior costal facets	pit
#67	T12	superior body	depression
	a thoracic vertebra	inferior body	depression
	a thoracic vertebra	superior body	depression

Appendix G - continued

Other Pathologies of the Vertebral Column

Individual	Bone	Location	Description
#67	L4		an extra facet adjacent and inferior to each inferior articular facet
#78	a thoracic vertebra	inferior body	depression

Dental Pathologies

Individual	Location	Description
#1	maxilla	alveolar recession
#11	maxilla	second and third molars, left central incisor and left lateral incisor lost antemortem alveolar recession
	mandible	all molars lost antemortem
#12	maxilla	right lateral incisor, right canine, and all premolars and molars lost antemortem infection at right second molar alveolar recession

Appendix G - continued

Dental Pathologies

Individual	Location	Description
#12	mandible	left second molar, left premolars, left canine, central and lateral incisors, right first premolar, right canine, and right first molar lost antemortem alveolar recession
#18	maxilla	tooth sockets of first permanent molars enlarged
#26	maxilla	a right premolar absent alveolar recession left second premolar fractured antemortem
	mandible	third molars absent abscess at apex of root of left second premolar
#36	maxilla	two caries-in left first deciduous molar, and left central incisor

Appendix G - continued

Dental Pathologies

Individual	Location	Description
#36	mandible	one caries -in left central incisor
#40	maxilla	left first and third molars, all incisors, right canine, right pre-molars and right molars lost antemortem infection in region of right premolars and molars
	mandible	all molars, left second premolar, central incisors, right lateral incisor, right first pre-molar lost antemortem
#43	mandible	crowding of left central incisor
#50	maxilla	right third molar lost antemortem alveolar recession
#61	maxilla	right first premolar rotated, possibly lost antemortem
	mandible	right second and third molars lost antemortem alveolar recession

Appendix G - continued

Dental Pathologies

Individual	Location	Description
#62	?	caries in an unidentifiable loose tooth, possibly an incisor or a canine
#72	mandible	crowding of first premolars

Miscellaneous Pathologies

Individual	Bone	Location	Description
#1	left radius	radial tuberosity	gap related to attachment of biceps muscle
	sternum		manubrium and mesosternum fused together
#4	clavicles	sternal end, inferior surface	rhomboid fossae
	a left rib	head	eosinophilic granuloma?
#11	left scapula	lateral border	bony nodules at location of triceps attachment
	manubrium	right 1st costal cartilage notch	ossification of costal cartilage

Appendix G - continued

Miscellaneous Pathologies

Individual	Bone	Location	Description
#11	sternum		fusion of manubrium and mesosternum
	humeri	tubercles	pitting indicating possible inflammation of supraspinatus and subscapularis muscles
	right radius	radial tuberosity	pitting indicating possible inflammation of biceps muscle
#12	right parietal		button osteoma
	1st ribs	costal end	ossification of costal cartilage
	3 left ribs	neck	ossification of superior costotransverse ligament
#22	left 1st rib	costal end	ossification of costal cartilage
#24	right parietal		small holes
#40	skull	occipital condyles	unusual notching at anterior edge
#43	humeri	anterior surface, proximal shaft	impressions for pectoralis major and teres major muscle attachments

Appendix G - continued

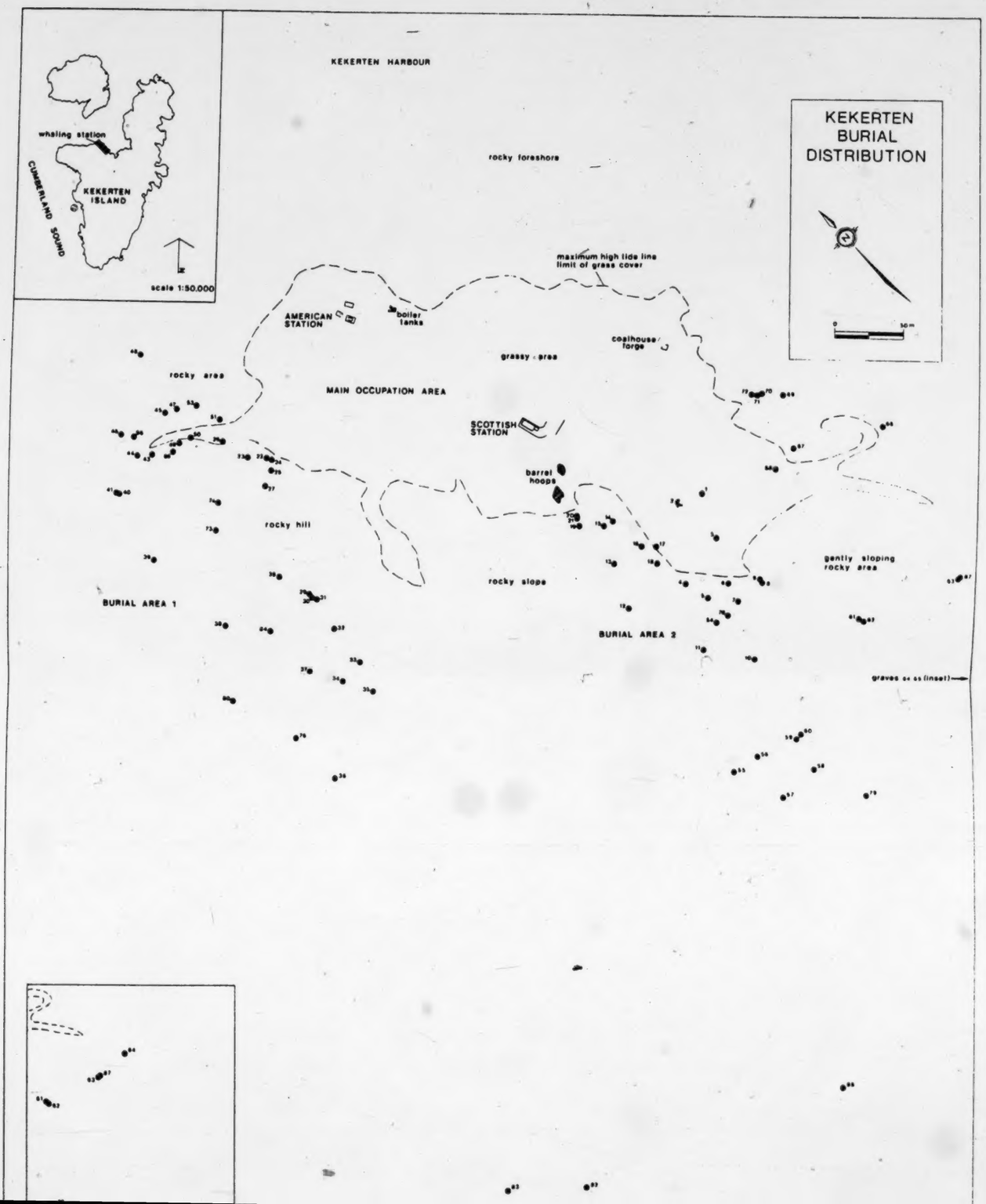
Miscellaneous Pathologies

Individual	Bone	Location	Description
#43	right clavicle a left rib	sternal end non-articular part of tubercle	rhomboid fossa small pit
#45	left femur	anterior shaft	focal periostitis
#50	left clavicle	sternal articular surface	pitting related to fusion of epiphysis
#57	frontal bone	upper surface of orbits	cribra orbitalia
#59	manubrium	1st costal cartilage notches	ossification of costal cartilage
	1st ribs	costal end	ossification of costal cartilage
#61	manubrium	right 1st costal cartilage notch	ossification of costal cartilage
#64	1st ribs	costal end	ossification of costal cartilage
#65	left humerus	anterior and medial proximal shaft	impressions for pectoralis major and teres major muscle attachments

Appendix G - continued

Miscellaneous Pathologies

Individual	Bone	Location	Description
#66	manubrium	1st costal cartilage notches	ossification of costal cartilage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whaling station
CUMBERLAND SOUND
KEKERTEN ISLAND
scale 1:50,000
KEKERTEN BURIAL DISTRIBUTION
rocky foreshore
maximum high tide line
limit of grass cover
AMERICAN STATION
boiler tanks
coalhouse / forge
grassy area
rocky area
MAIN OCCUPATION AREA
SCOTTISH STATION
barrel hoops
rocky hill
rocky slope
gently sloping rocky area
BURIAL AREA 1
BURIAL AREA 2
graves as at (inset)

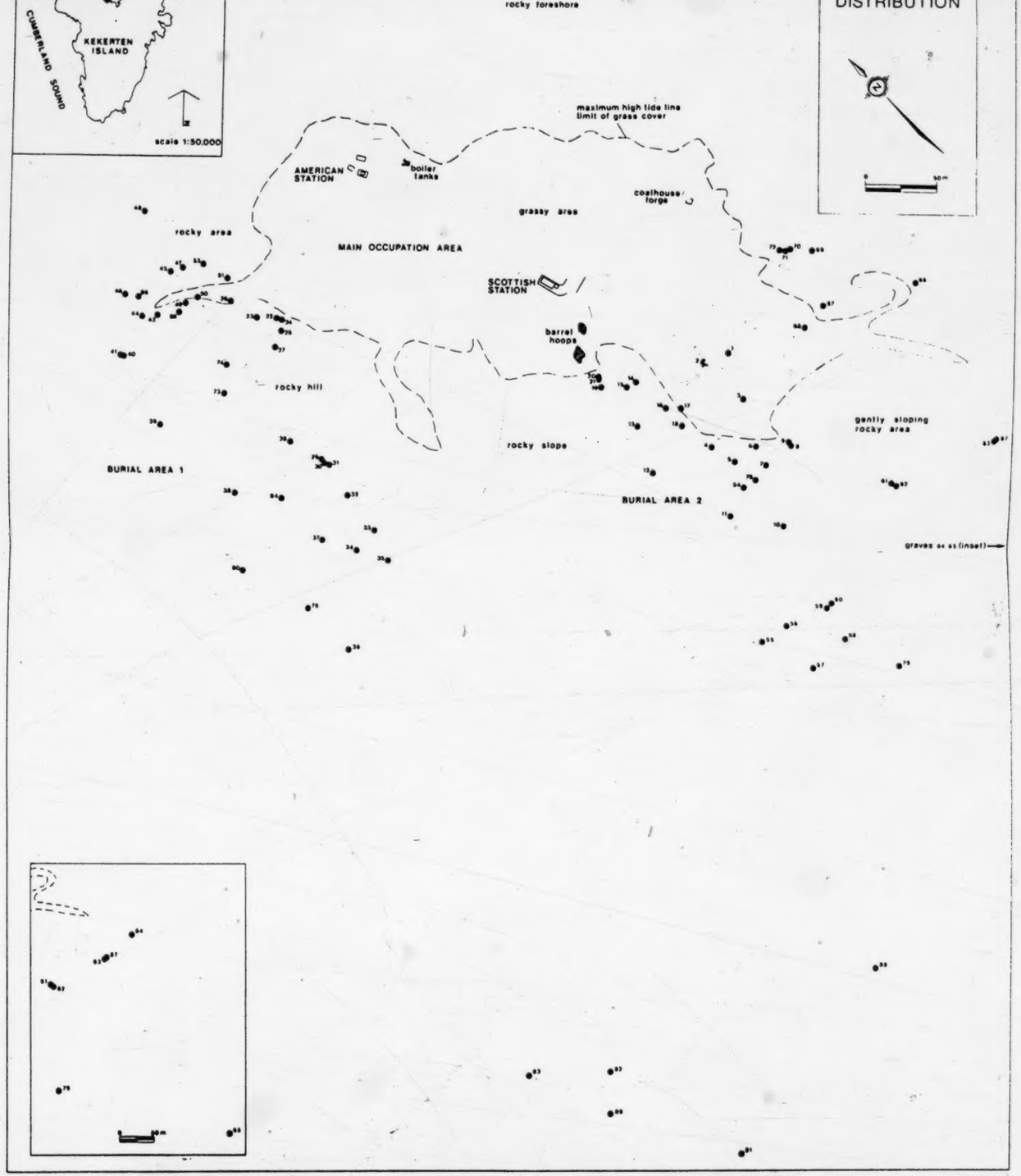

Figure 3 (modified from Dept. Public Works, Govt. N.W.T. map, Project No. 85-4401)